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PLATELAYERS' GUIDE

WITH

TABLES AND DIAGRAMS

OF

SWITCHES AND CROSSINGS

BY

THOMAS SUMMERSON & SONS, Ltd.

DARLINGTON

FIFTH EDITION, 1904

PRICE, 5/-

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HANDY
PLATELAYERS' GUIDE

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PLATELAYERS' GUIDE

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1904

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PREFACE.

The first edition of this Handbook appeared in 1879, the second in 1885, the third in 1895, the fourth in 1901, and we now submit a fifth. The first two editions were printed on folding boards and consisted of little more than Tables for the 4 ft. 8½ in. gauge. The 1895 edition was put into book form and the Tables extended to cover all the usual gauges, and a good deal of information useful to Platelayers added.

The present edition is in most respects like its predecessor, the text has, however, been revised, and some of the woodcuts which were lacking in clearness have been improved. In the Tables for the 4 ft. 8½ in. gauge we have added a column giving the radii of the curves in chains, in addition to the one in feet and inches. We would point out that in this edition we use the word "Switches" instead of "Points" throughout, to prevent confusion with "Point," as applied to one of the Crossing rails, that is to say, in a set of Switches and Crossings we have the Switches consisting of Switch Rails and Stock Rails, and the Crossings consisting of Point, Splice, Wing and Guard Rails.

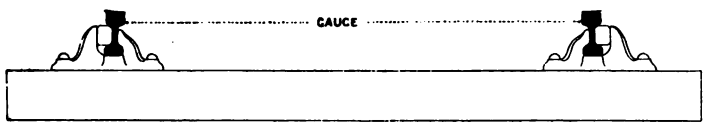
Any corrections or suggestions whereby the utility of this work might be increased will receive due acknowledgment.

ALBERT HILL FOUNDRY,
DARLINGTON, *28th April*, 1904.

GENERAL INFORMATION.

Gauge. The Gauge of a railway is always measured inside of the top heads of the rails, thus :—

FIG. 1.



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The Standard gauge, not only in Great Britain, but on the Continent and in the United States, is 4 ft. 8½ in. This gauge dates back to the plate-ways laid down to facilitate the traction of ordinary road vehicles drawn by horses, before the introduction of railways. These plates had a vertical flange on the inside to guide the wheels, and were laid to a gauge of 5 ft. measured over the outside. On the introduction of flanged wheels, made necessary by objections to the flanges of the plates standing above the roadway, the plates were altered, and the gauge measured inside of the plates became 4 ft. 8½ in. as at present. The first flanged wheels it appears were used with the flanges outside, and were reversed for one reason amongst others, that the pressure against the flanges might tend to keep the wheels on the axles instead of the reverse.*

* See "The History of Railway Permanent Way," by Clement E. Stretton, C.E.

Rails, which superseded these plates, were for a long time called Plates, hence the name Platelayer.

The broad gauge, introduced by Brunel on the Great Western Railway, was 7 ft. Its advocates expected that it eventually would supersede the 4 ft. $8\frac{1}{2}$ in. gauge, but the battle of the gauges which ensued resulted in a victory for the latter. The Irish gauge is 5 ft. 3 in., and in India the two principal gauges in use are the metre (3 ft. $3\frac{3}{8}$ in.) and the 5 ft. 6 in. gauge. The foregoing are the gauges of the most important railway systems of the world. The other gauges represented in our Tables from 1 ft. 6 in. upwards are those used principally for short independent lines, light railways, and portable railways.

Weight of Rail per Yard. The wider the gauge the greater the load per axle that can be carried, and the heavier the rails required. Having determined the load per axle it is intended to carry, including the weight of the vehicle, the most suitable weight of rail can be found by the formula $W = \sqrt{L \times S \times C}$

W = Weight of rail in lbs. per yard.
L = Maximum load on any axle, in tons.
S = Distance centre to centre of sleepers, in feet.
C = Constant: 130.

The Table on the opposite page is based upon the above formula.

TABLE OF WEIGHT OF RAILS, WITH CORRESPONDING GAUGE SIZES OF BOLTS, SPIKES, AND SLEEPERS.

Greatest Load per Axle, in Tons.	Weight of Rail in Lbs. per Yard.		Size of Fish Bolts.	Size of Dog Spikes for Flange Rails.	Size of Round Chair Spikes.	Size of Sleepers in Standards.	Gauge of Road.
	Sleepers, 2 ft. 6 in. Centres.	Sleepers, 3 ft. Centres.					
¼	9	10	$\frac{5}{16}$ to $\frac{3}{8}$ in.	¼ × 2 in.	$\frac{5}{16}$ in.	$4\frac{3}{4}$ × $2\frac{3}{8}$ in.	1 ft. 6 in.
½	13	14	$\frac{3}{8}$ to $\frac{7}{16}$,,	$\frac{5}{16}$ × $2\frac{1}{4}$,,	$\frac{3}{8}$,,	$4\frac{3}{4}$ × $2\frac{3}{8}$,,	1 ft. 6 in. to 2 ft. 0 in.
1	18	20	$\frac{7}{16}$ to ½ ,,	$\frac{3}{8}$ × $2\frac{1}{2}$,,	$\frac{7}{16}$,,	5 × $2\frac{1}{2}$,,	1 ,, 6 ,, to 2 ,, 6 ,,
2	25	28	½ to $\frac{9}{16}$,,	$\frac{7}{16}$ × 3 ,,	$\frac{7}{16}$,,	6 × 3 ,,	2 ,, 6 ,, to 3 ,, 0 ,,
4	36	39	$\frac{9}{16}$ to $\frac{5}{8}$,,	½ × $3\frac{1}{2}$,,	½ ,,	7 × $3\frac{1}{2}$,,	3 ,, 0 ,, to 3 ,, 6 ,,
6	45	48	$\frac{5}{8}$ to $\frac{11}{16}$,,	$\frac{9}{16}$ × $3\frac{1}{2}$,,	½ to $\frac{5}{8}$ in.	7 × $3\frac{1}{2}$,, 8 × 4 ,,	3 ,, 6 ,, to 4 ,, $8\frac{1}{2}$,,
8	50	56	¾ in.	$\frac{5}{8}$ × $4\frac{1}{2}$,,	$\frac{5}{8}$ to ¾ ,,	9 × $4\frac{1}{2}$,,	3 ,, 6 ,, to 4 ,, $8\frac{1}{2}$,,
10	57	63	¾ to $\frac{7}{8}$ in.	$\frac{5}{8}$ × $4\frac{1}{2}$,,	¾ in.	9 × $4\frac{1}{2}$,,	4 ft. $8\frac{1}{2}$ in.
15	70	76	$\frac{7}{8}$ in.	¾ × 5 ,,	$\frac{7}{8}$,,	10 × 5 ,,	4 ,, $8\frac{1}{2}$,,
20	80	90	$\frac{7}{8}$ to 1 in.	¾ × 5 ,,	$\frac{7}{8}$ to 1 in.	10 × 5 ,,	4 ,, $8\frac{1}{2}$,,

Curves. The gauge, the wheel base—that is, the distance centre and centre of the fixed wheels which are farthest apart—and the curve radius, are all co-related. Given the gauge, the wheel base of the locomotives and vehicles should stand in some proportion to it, and the radius of the curves to both. A wheel base the same as the gauge is a short one, twice the gauge may be considered a fair average, whilst three times the gauge is long. Practical tests go to show that a slight variation of the wheel base has not a very marked effect upon the resistance, but for safe working it is advisable to vary the radius according to the wheel base, for example, if we have a 5 ft. wheel base and a curve twelve times this, or 60 ft., should we increase the wheel base to 10 ft. the curve should be increased in the same ratio, that is to 120 ft.

On the 4 ft. 8½ in. gauge a four-wheeled locomotive with a 9 ft. 6 in. wheel base will work a 55 ft. curve if the gauge is widened half an inch, and a railway truck with a wheel base of 8 ft. 6 in. can be slowly swerved round a curve so short as 30 ft. if the gauge is widened 1 in., but only the exigencies of restricted space justify such curves; and when laying out new sidings they should be studiously avoided, for short curves are bad economy, causing not only excessive wear and tear both to the rolling stock and the rails, but locking of buffers and derailment.

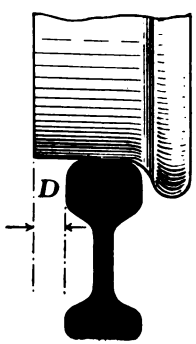
The following Table of proposed minimum radii,

applicable to wheel bases not exceeding twice the gauge, is the result of practical experience.

Gauge.			Working Minimum Radius.		Practicable for Slow Speeds by Widening the Gauge.	
Ft.	In.		Ft.	In.	Ft.	In.
1	6		12	6	7	6
2	0		22	0	10	0
2	6		34	0	16	0
3	0		50	0	23	0
3	$3\frac{3}{8}$	(metre)	59	0	27	0
3	6		67	0	30	0
4	$8\frac{1}{2}$		120	0	55	0
5	3		150	0	70	0
5	6		165	0	76	0

Widening Gauge on Curves. To give more freedom on sharp curves, and to prevent the road being unduly strained by the pressure of the wheel flanges, it is sometimes advisable to widen the gauge a little, thus giving more clearance between the wheel flanges and the rails; this additional width should not exceed the overlap of the tyres **D** (See Fig 2 below), measured on the narrowest tyre in use.

FIG. 2.



Within the limit laid down on the preceding page, the additional play, having reference to the radius of the curve and the wheel base, may be found by the following formula :—

R = Radius of curve, in feet.
G = Gauge, in feet.
W = Addition to gauge, in inches.

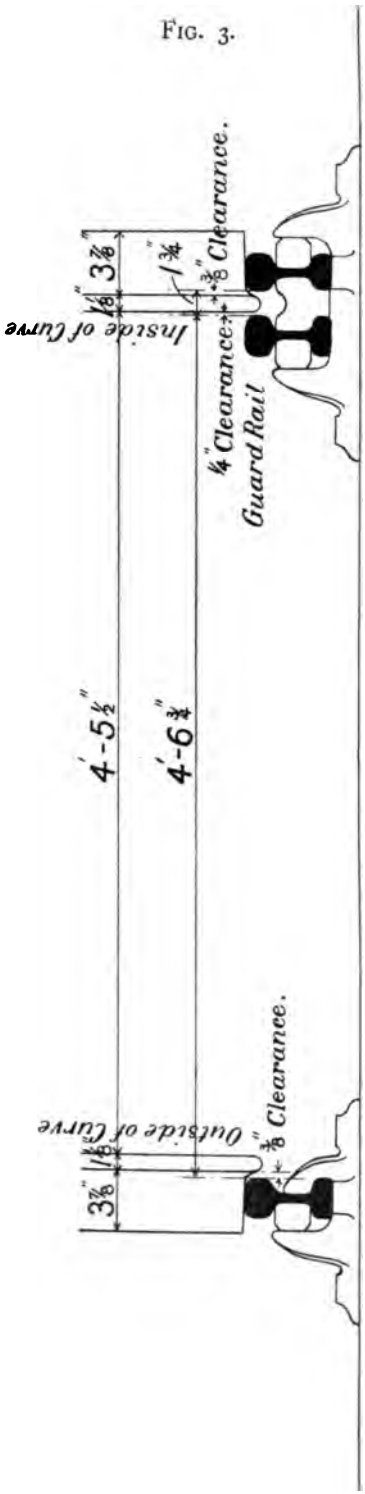
When the longest wheel base = G then $W = \frac{20}{R}$
Do. do. = G × 2 then $W = \frac{44}{R}$
Do. do. = G × 3 then $W = \frac{98}{R}$

Where guard rails are used on a widened curve the flangeway should be increased by one-half the extra width given to the gauge.

Flangeway Clearance and Guard Rails. 4 ft. 8½ in. Gauge.

The factors determining the width of the flangeways between the guard rails and the main rails are the thickness of the wheel flanges and the clearance allowed. For example, taking the 4 ft. 8½ in. gauge, the flangeway is usually 1¾ in. and the wheel flanges 1⅛ in. thick, leaving ⅝ in. clearance in all ; the wheels are keyed on to the axles to measure 4 ft. 5½ in. back to back, which leaves ⅜ in. clearance on each side between the working faces of the rails and the flanges, and ¼ in. clearance between the back of the wheels and the guard rails ; thus, when the back of the wheel is working in touch with the guard rail (which is generally the case on a curve), there is a clearance of ⅛ in. between the working faces on the opposite

FIG. 3.



rail. The Fig. 3 shows the wheels in their normal position with equal clearance on each side.

The flangeway at the heels of the switches should be wide enough to give sufficient clearance, when open, at the set in the points where the planing ends, which means. in a general way, that it should be $\frac{1}{8}$ to $\frac{1}{4}$ in. wider than the guard rail clearance. The clearance is the same at both heels, but for very short curves—angles 1 in 3 and under—it is advisable to give more clearance to the heel at the inside of the curve, to compensate for the disparity due to the difference in radii of the curves, which is accentuated when they are very short.

The vertical flangeway clearance between the top of the rails and chairs or distance blocks should not be less than $1\frac{1}{2}$ in.

Super-elevation of the Outer Rail on Curves.

On curves, to relieve the side pressure of the wheel flanges against the rails due to the tendency of the trains to go forward in a straight line, it is necessary to elevate the outer rail above the inner one by packing up the sleepers. The amount of this super-elevation theoretically is directly as the square of the speed, and inversely as the radius of the curve, and it should be adjusted for the speed of the fastest traffic. Where it is not practicable to raise the outer rail, check rails should be applied to the inner rail to prevent the wheels from climbing over the outside one, which they have a tendency to do if the wheel flanges are allowed to press close to the rail. A table of super-elevations will be found on page 106, deduced from the formula $E = \frac{V^2 \times 5}{2R}$

E = Super-elevation of outer rail, in inches.

V = Speed of train, in miles per hour.

R = Radius of curve, in feet.

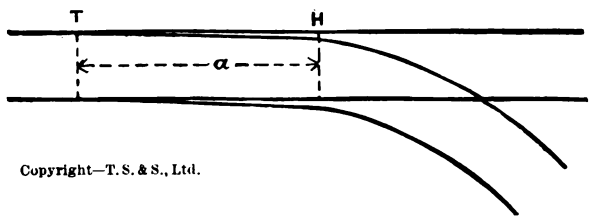
5 = Constant for the 4 ft. $8\frac{1}{2}$ in. gauge.

This formula gives the minimum super-elevations required. For other gauges E varies in direct ratio, half the super-elevation being required for a 1 ft. 6 in. gauge that is necessary for a 3 ft. one. All curves of less than 100 ft. radius on the 4 ft. $8\frac{1}{2}$ in. gauge should be provided with guard rails, whether the outer rails are elevated or not.

Switches 4 ft. 8½ in. Gauge.

Switches are made of various lengths, to suit the situation for which they are intended, the usual lengths for the 4 ft. 8½ in. gauge for main lines being 12 ft., with a proportion of 15 ft. and 18 ft., whilst for sidings about works the lengths are shorter—9 ft. down to 6 ft. The principal object of long switches is to make an easy turn off; they have also the advantage of additional stability as compared with short ones, for, being secured only at one end, switches are liable to rock and jump when heavy loads are passing over them. The lengths of switches should in a measure be adapted to the radius of the curve, for obviously there is no advantage in making the angle at the toe less than the angle at the heel. This will more readily be understood by reference to Fig. 4 below, which shows a pair of long switches (*a*) applied to a short curve, where the abruptness of the turnout is only transferred from the toe (T) to the heel (H).

FIG. 4



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In general practice where the width between the rails at the heels is a constant 1¾ in. to 2 in. nothing is gained by making the switches longer

than twice the angle of the crossing in feet, that is to say, 9 ft. is a better length for a 1 in $4\frac{1}{2}$ crossing than 12 ft., and longer switches than 12 ft. can only be used with advantage when the crossings are upwards of 1 in 6. Any length of switches might be used irrespective of the crossing angle if the width between the rails at the heels were varied accordingly, but as each length would require a different width of heel chair, the system is not to be recommended, except for switches for very wide angles, say 1 in $3\frac{1}{2}$ and under, where a long curved switch rail makes a better job than the short straight ones usually supplied. Facing switches should always be made the extreme length compatible with the above conditions.

The length of stock rails varies, the minimum being 3 ft. or 4 ft. longer than the switches, sometimes the standard length of rail in use on the particular railway is used, no hard and fast rule can be stated, only suitable distances at each end of the switches should be allowed for spacing the chairs with reference to the joints.

Lever Boxes. There is a great diversity in the patterns of Lever Boxes in use, and every Platelayer has his own particular fancy. A perfect Lever Box should embody the following points :—

(1) It should not take up much space.

(2) Whilst being easy to work by the shunter, it should always bring the switches home with certainty.

(3) It should be readily changeable from a "Turn-over Lever," which leaves the switches indifferently on one side or the other to a "Self-acting Lever," whereby the switches are always brought back to the same side.

(4) It should possess facilities for padlocking, either to self-act always for one particular side, or to prevent it being worked at all except by authorized hands.

(5) It should possess fewness of parts, and not be liable to get out of order.

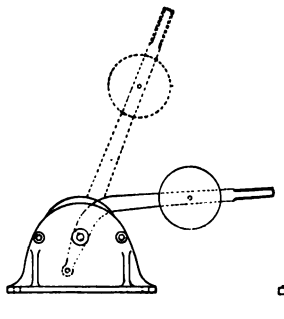
(6) When adjusted for a "Throw-over Lever," it should fly over and change the switches when vehicles are shunted backwards through—that is, from heel to toe of the switches, otherwise changing the direction of a train when on the switches will cause derailment.

On page 12 we illustrate a few types of Lever Boxes.

No. 1 is an old pattern which still survives in the North of England. It has the merit of extreme simplicity, but is only satisfactory when used as a self-acting box with the lever bent, for when used as a turn-over with a straight lever there is not sufficient weight against the switch points.

Nos. 7, 10, 14, and 18 are fitted with a sector which was introduced by Thomas Summerson & Sons, to enable a Lever Box to be readily changed

TYPES OF LEVER BOXES.



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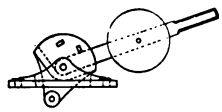

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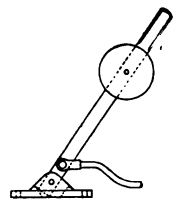

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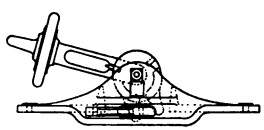

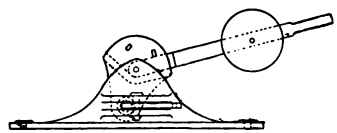

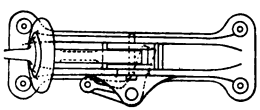

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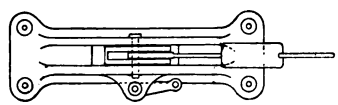

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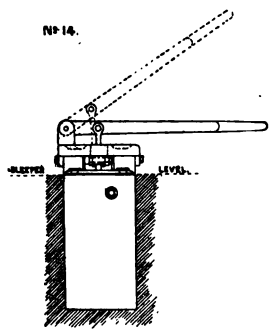

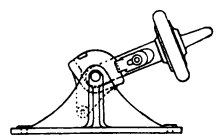

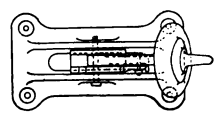

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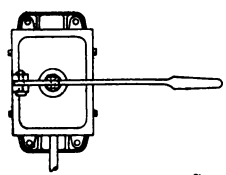

Nº 8.

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NOTE.—The Numbers refer to Thomas Summerson & Sons' (Ltd.) Patterns.

from self-acting to turn-over or *vice versa.* In its normal condition the Lever is a turn-over, closing the switches on either side, just as the shunter happens to leave it, and when it is required to bring the switches back always to the same point, it is only necessary to fix the lever by a wedge provided for the purpose, to one end or other of the sector, according to which road it is intended to keep open, in which positions it can be padlocked.

Patterns Nos. 10 and 14, in addition to the sector mentioned above, are provided with a bell crank in the side, enabling the Lever box to be fixed parallel with the railway, in which position it can be fixed to the sleepers of the switches if two of these are made long enough. Lever Boxes of this description are necessary where space is limited.

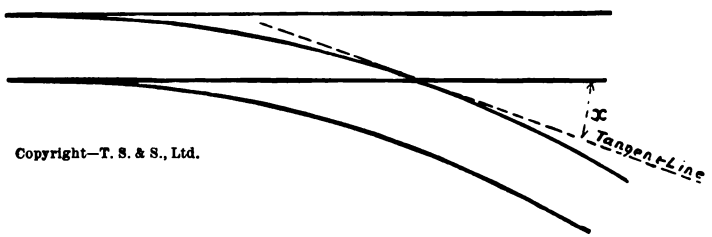
No. 5 is a type which comes in useful where it is important there should be as little obstruction above the level of the ground as possible, as for instance, on docks and wharves where there is general traffic. It is also made with a vertical lever which is removable.

No. 15 is a Lever in its simplest form as used for light work, and by contractors for temporary lines.

Crossings, 4 ft. 8½ in. Gauge. The angle of a crossing is that which is formed by a tangent to the curve at the point of intersection. See Fig. 5 on the following page, in which x is the angle.

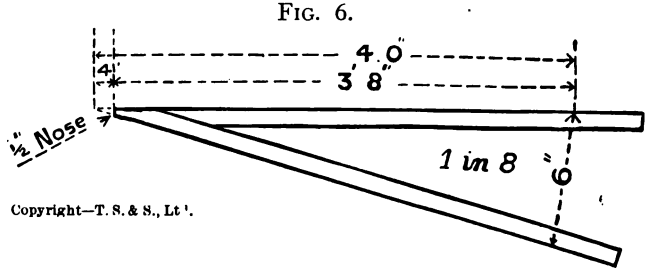
When ordering crossings to replace those in use, the simplest plan is to measure the width of the Crossing Vee across the outside of the rails at a distance of, say 4 ft. back from the nose, in which case the crossing should be specified thus—6 in. (or

FIG. 5.



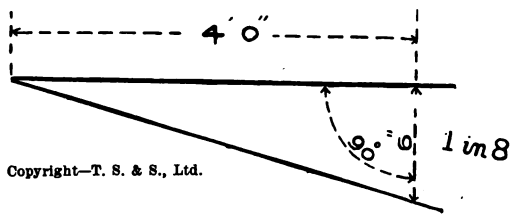
whatever the distance may be) at 4 ft. from actual nose of crossing, for an error is sometimes made by Platelayers when specifying crossings, due to not taking into account the thickness of the crossing nose, thus giving the angle of a crossing which measures 6 in. at 4 ft. back from the nose, as 1 in 8, whilst if we assume that the nose is $\frac{1}{2}$ in. thick, the actual angle (found by dividing $5\frac{1}{2}$ in. into 4 ft.), is, say 1 in $8\frac{3}{4}$. This will more readily be understood by reference to Fig. 6, given below.

FIG. 6.



The above is the usual method of measuring the angle of a crossing in this country. Another plan in use on some of our Indian Railways is to measure the Vee across at right angles to one of the legs, as shown by Fig. 7.

FIG. 7.



Crossings are made right and left hand for main lines, the point rail being always laid for the main way, and the splice rail for the turnout or siding; thus in Fig, 6 the Vee shown is for a lefthand crossing to suit a curve turning off to the lefthand when facing the points. For sidings they may be made all the same hand.

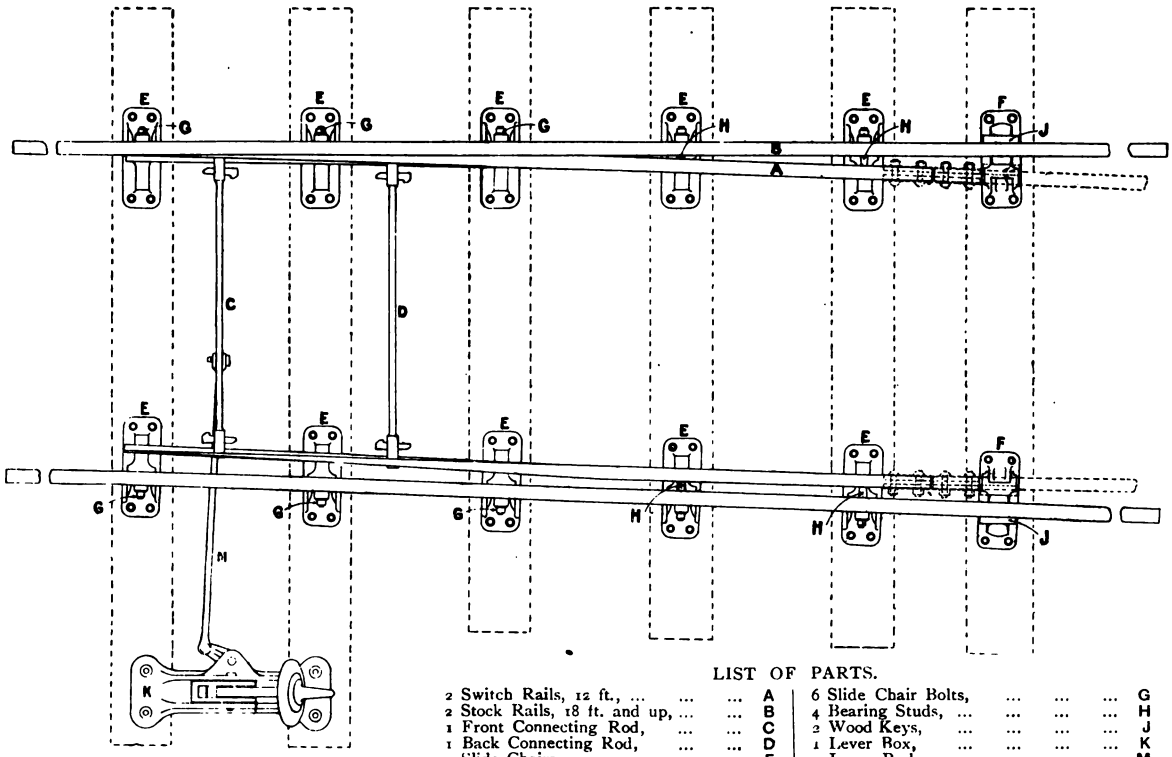
When measuring the angles off a drawing, care should be taken to lay down the tangent lines referred to (see Fig. 5), instead of, as is sometimes done, measuring on the curved line. It is not necessary to include fractions in the angles of crossings, except for the more obtuse ones, and those given in our tables will meet all ordinary cases, but when a fraction appears in a calculation, it is better to take the next higher rather than the lower number; for instance suppose the angle worked out to 1 in $6\frac{5}{8}$, we should make the crossing 1 in 7, for it is easier to adapt a crossing to a situation when it is made rather too acute than the reverse. With

regard to the length of the various rails composing a crossing, it is impossible to lay down any hard and fast rule. For main line purposes Vee rails vary from 8 ft. to 12 ft., and the wing rails from 12 ft. up to the full length of the standard rail, and for sidings the Vees are made from 6 ft., and the wings from 7 feet upwards. Check rails should always be at least 4 or 5 ft. longer than the distance between the crossing knees and the nose; but to allow sufficient latitude in fixing, and for suitably arranging the chairs and sleepers, they are generally made much longer. For main lines a usual length is 12 ft., whilst for sidings they run from 7 to 9 ft.

Crossings of angles under 1 in $3\frac{1}{2}$ should be ordered curved to the radius from the makers, for when this is not done it is very difficult to make a satisfactory curve, or one that is not much quicker than intended, owing to the short lead (distance **D** in Tables), and the greater proportion of this distance occupied by the straight part of a crossing as it is usually made. As an alternative, when straight crossings are supplied, the lead should be increased by taking the next higher; for instance, if the angle is 1 in $1\frac{3}{4}$, use the distance **D** which is specified for 1 in 2, and so on, up to 1 in 4 for a 1 in $3\frac{1}{2}$ crossing.

Crossings less than 1 in $2\frac{1}{2}$ should have the wing rails long enough to close up to the heels of the switches to avoid short pieces of making-up rail.

On the following pages we illustrate a few of the most usual types of Switches and Crossings, with lists of their constituent parts, also a few examples of combinations of Crossings, from photographs.



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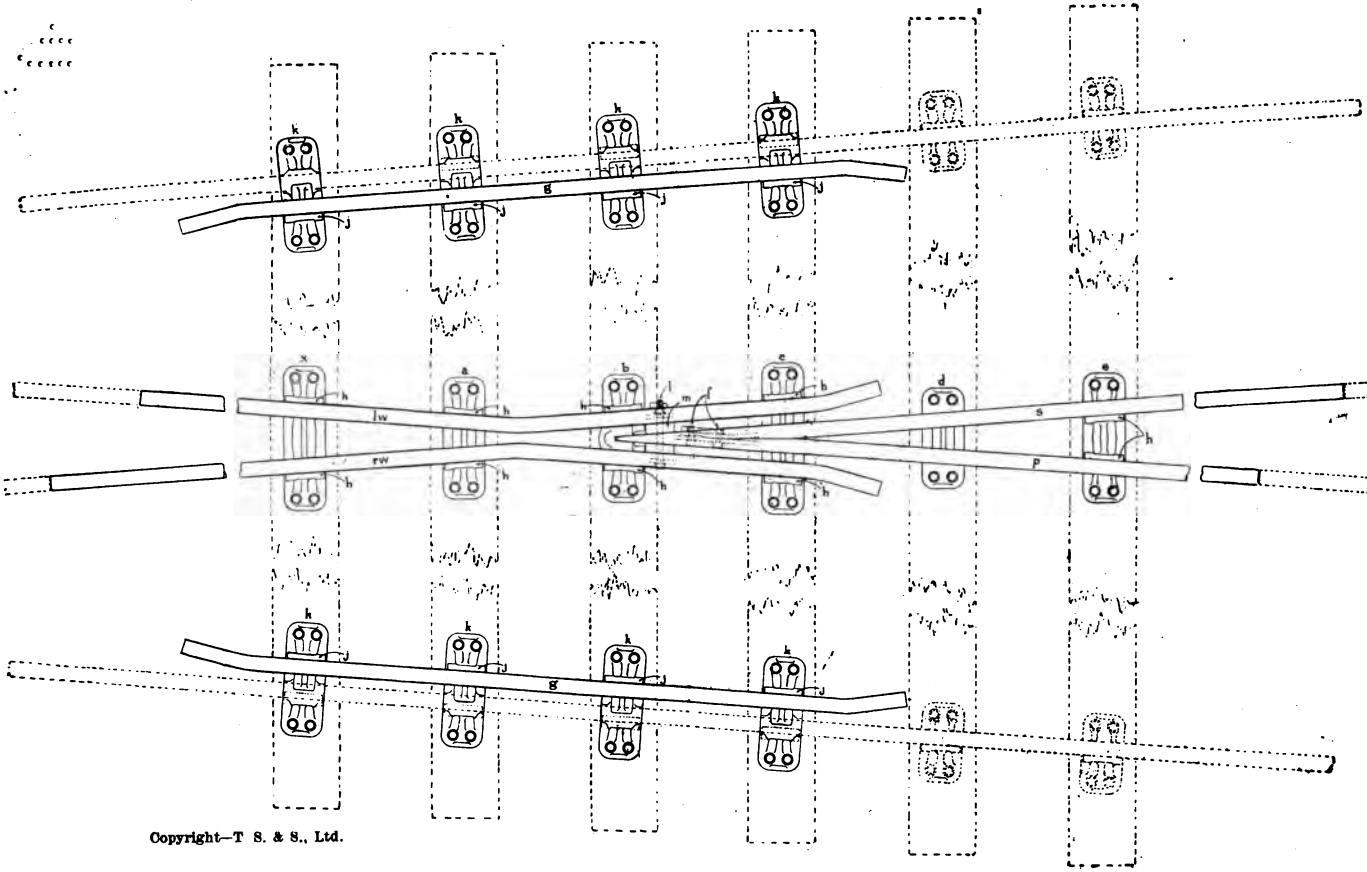
LIST OF PARTS.

2 Switch Rails, 12 ft., ...	A	6 Slide Chair Bolts, ...	G
2 Stock Rails, 18 ft. and up, ...	B	4 Bearing Studs, ...	H
1 Front Connecting Rod, ...	C	2 Wood Keys, ...	J
1 Back Connecting Rod, ...	D	1 Lever Box, ...	K
10 Slide Chairs, ...	E	1 Lever Rod, ...	M
2 Back Heel Chairs, ...	F		

9-ft. Switches have the following parts :—

2 Switch Rails, 9 ft., ...	A	6 Slide Chair Bolts, ...	G
2 Stock Rails, 15 ft. and up, ...	B	2 Bearing Studs, ...	H
1 Front Connecting Rod, ...	C	2 Wood Keys, ...	J
8 Slide Chairs, ...	E	1 Lever Box, ...	K
2 Back Heel Chairs, ...	F	1 Lever Rod, ...	M

Crossing for Main Lines from B.H. Rails.



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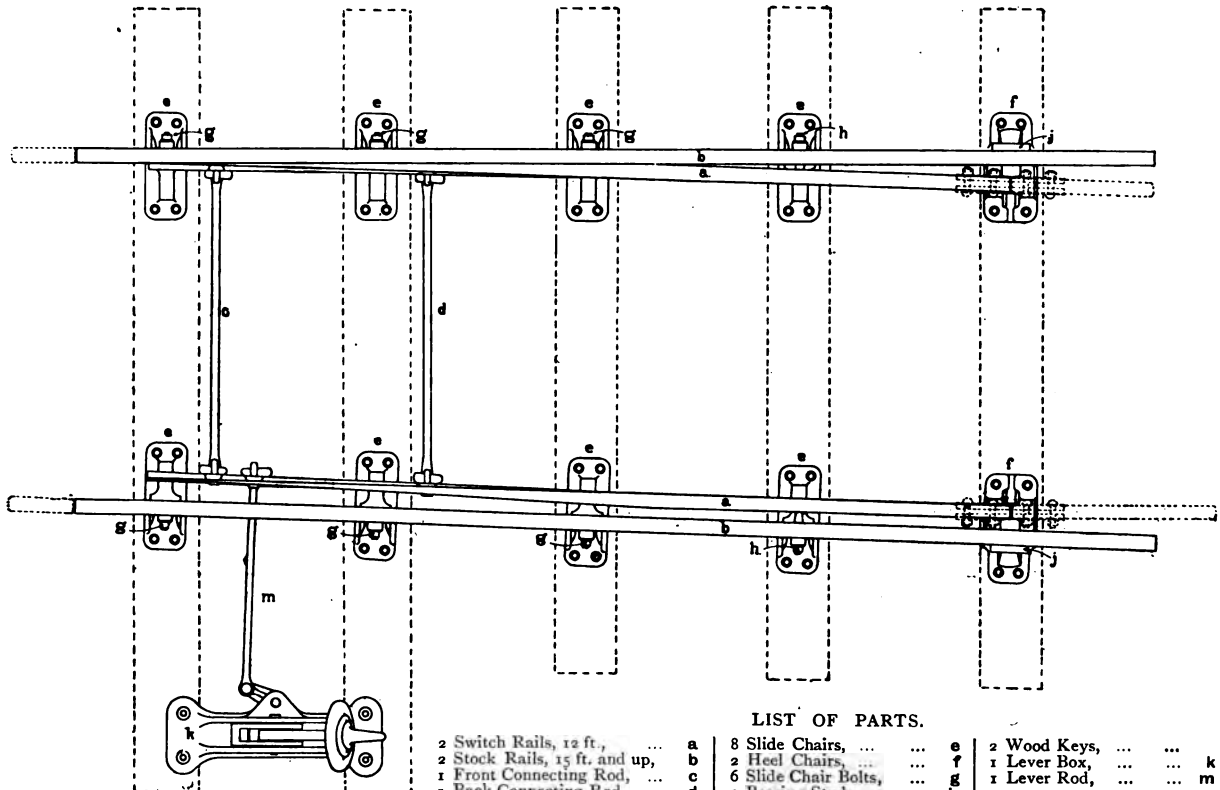
LIST OF PARTS.

Point Rail, ...	p	Left Wing Rail, ...	lw	Guard Rail Chairs, ...	k	Distance Blocks for Crossing,	m
Splice Rail, ...	s	Guard Rails, ...	g	Keys for Crossing Chairs, ...	h	Bolt for Distance Blocks, ...	l
Right Wing Rail, ...	rw	Crossing Chairs,	x, a, b, c, d, e	Keys for Guard Rail Chairs,	j	Crossing Splice Bolts,... ...	f

12-ft. Switches for Ordinary Siding Purposes from B.H. Rails.



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LIST OF PARTS.

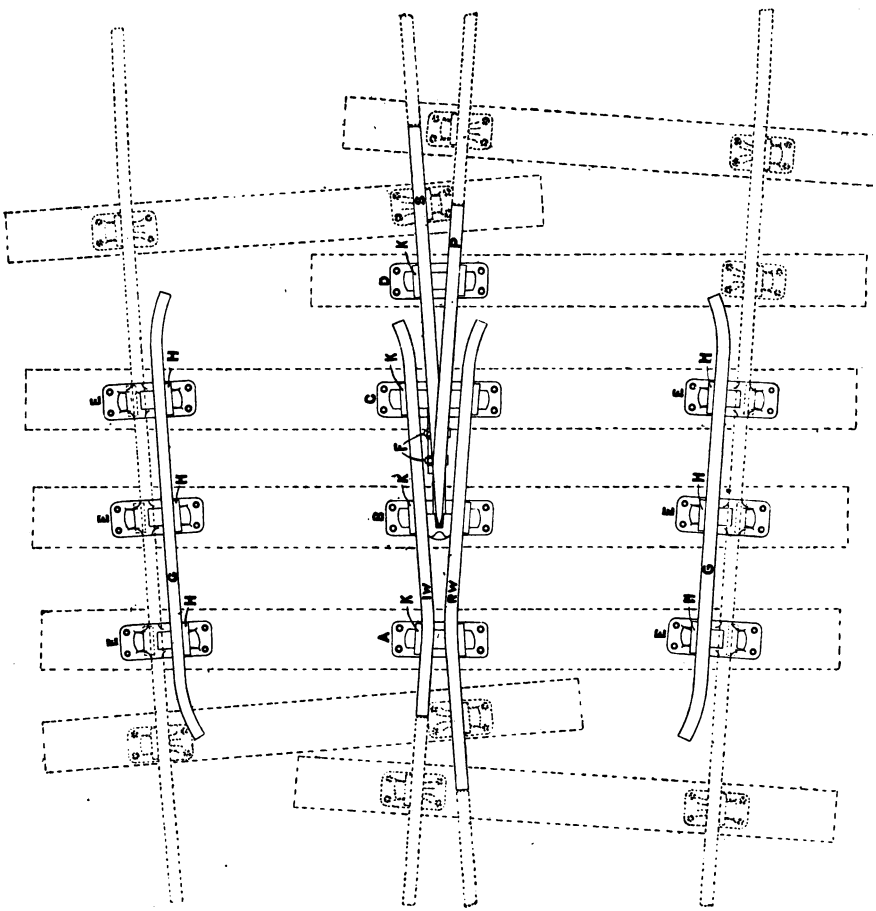
2 Switch Rails, 12 ft., ...	a	8 Slide Chairs, ...	e	2 Wood Keys, ...	
2 Stock Rails, 15 ft. and up,	b	2 Heel Chairs, ...	f	1 Lever Box, ...	k
1 Front Connecting Rod, ...	c	6 Slide Chair Bolts, ...	g	1 Lever Rod, ...	m
1 Back Connecting Rod, ...	d	2 Bearing Studs, ...	h		

9-ft. Switches have the following Parts :—

2 Switch Rails, 9 ft., ...	a	2 Heel Chairs, ...	f	2 Wood Keys, ...	j
2 Stock Rails, 12 ft. and up,	b	4 Slide Chair Bolts, ...	g	1 Lever Box, ...	k
1 Front Connecting Rod, ...	c	2 Bearing Studs, ...	h	1 Lever Rod, ...	m
6 Slide Chairs	e				

6-ft. Switches have the same parts as 9-ft., with 2 less Slide Chairs and Bolts

Crossing for Ordinary Siding Purposes from B.H. Rails.



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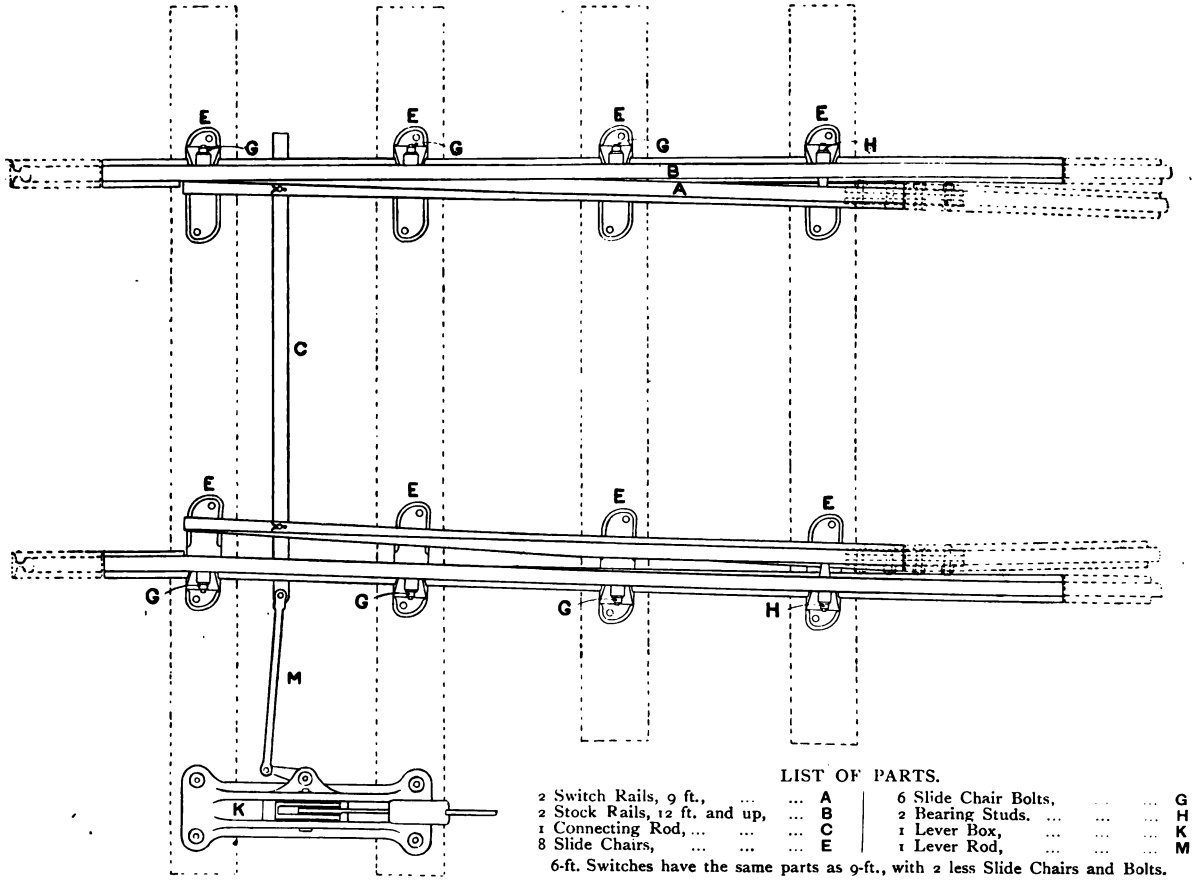
LIST OF PARTS.

1 Point Rail, ...	P	4 Crossing Chairs, ...	A, B, C, D
1 Splice Rail, ...	S	6 Guard Rail Chairs, ...	E
1 Left Wing Rail, ...	IW	2 Splice Bolts,...	F
1 Right Wing Rail, ...	RW	8 Keys for Crossing, ...	K
2 Guard Rails, ...	G	6 Keys for Guard Rails, ..	H

9-ft. Switches for Ordinary Siding Purposes from Flange Rails.



LIST OF PARTS.

2 Switch Rails, 9 ft., ...	A	6 Slide Chair Bolts, ...	G
2 Stock Rails, 12 ft. and up, ...	B	2 Bearing Studs.	H
1 Connecting Rod, ...	C	1 Lever Box, ...	K
8 Slide Chairs, ...	E	1 Lever Rod, ...	M

6-ft. Switches have the same parts as 9-ft., with 2 less Slide Chairs and Bolts.

12-ft. Switches have the same parts as 9-ft., with 2 extra Slide Chairs and Bolts, and 1 extra Connecting Rod.

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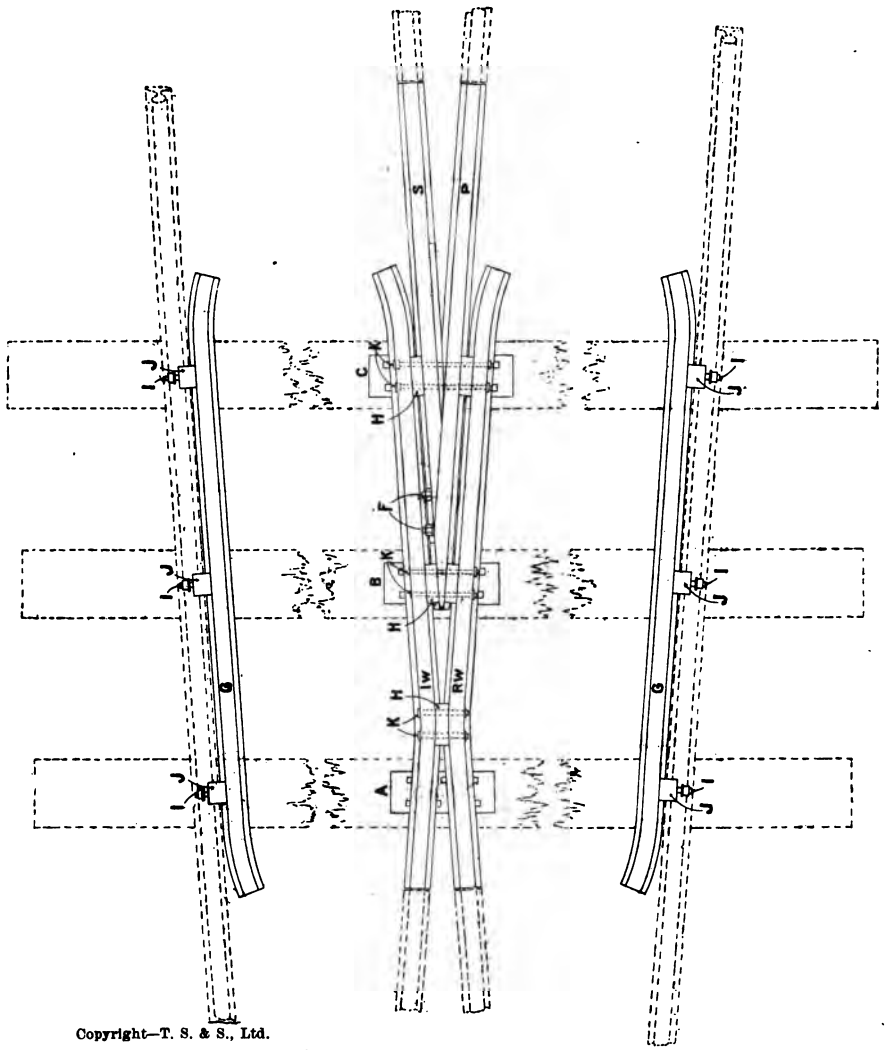
Crossing for Ordinary Siding Purposes from Flange Rails.



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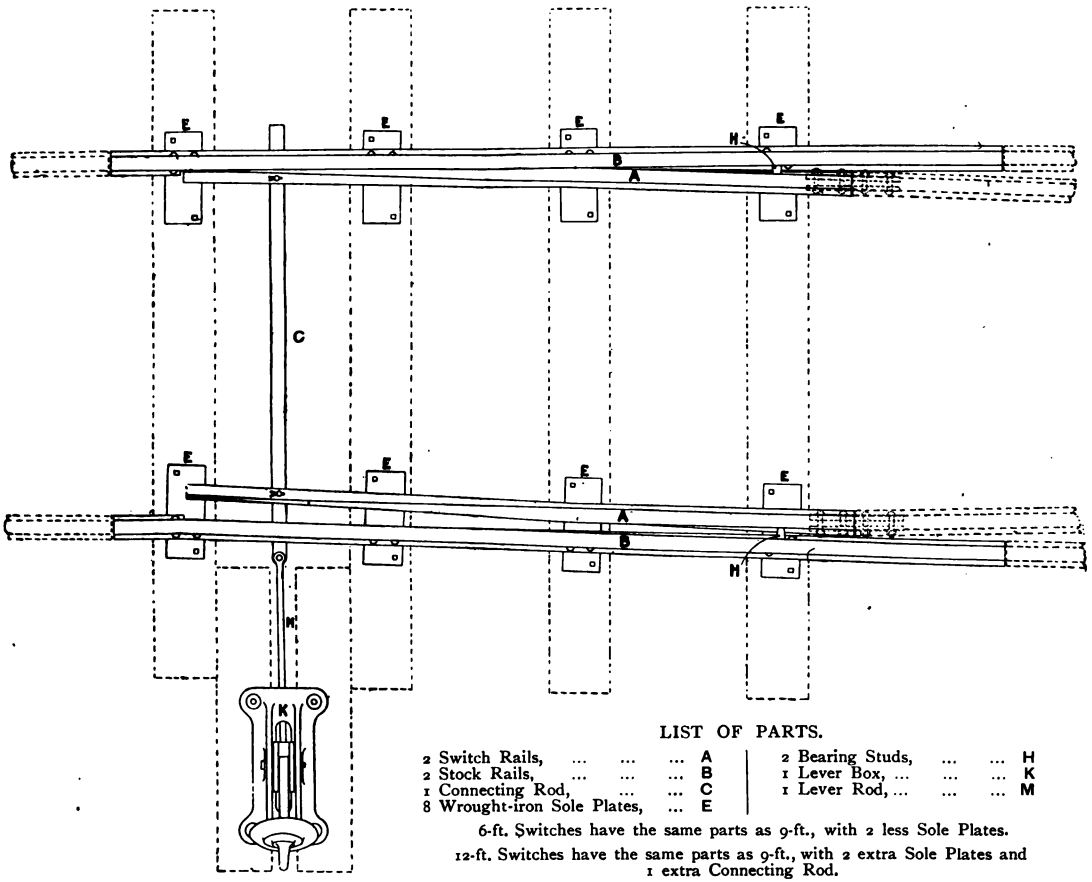
LIST OF PARTS.

1 Point Rail, ...	P	6 Guard Rail Blocks, ...	J
1 Splice Rail, ...	S	6 Crossing Bolts	K
1 Left Wing Rail, ...	IW	6 Guard Rail Bolts, ...	I
1 Right Wing Rail, ...	RW	2 Splice Bolts, ...	F
2 Guard Rails, ...	G	3 Wrought-iron Sole Plates, ...	A, B, C
5 Crossing Blocks, ...	H		



LIST OF PARTS.

2 Switch Rails, ...	A	2 Bearing Studs, ...	H
2 Stock Rails, ...	B	1 Lever Box, ...	K
1 Connecting Rod, ...	C	1 Lever Rod, ...	M
8 Wrought-iron Sole Plates, ...	E		

6-ft. Switches have the same parts as 9-ft., with 2 less Sole Plates.

12-ft. Switches have the same parts as 9-ft., with 2 extra Sole Plates and 1 extra Connecting Rod.

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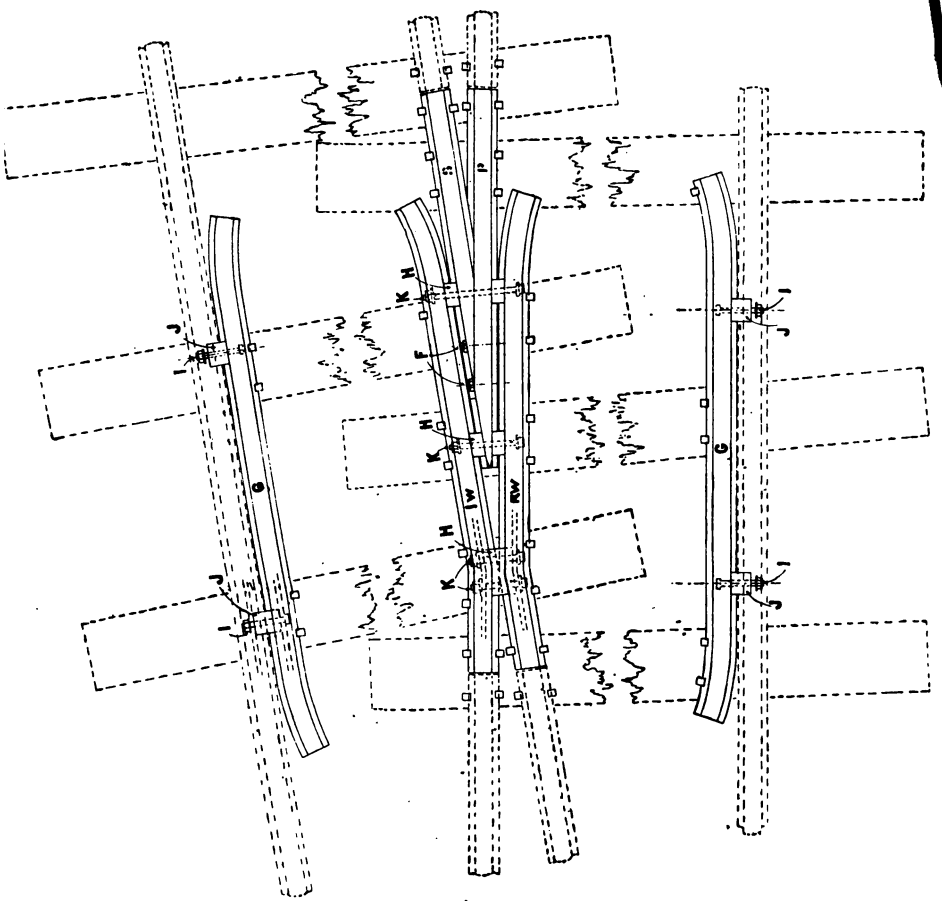
Crossing from Flange Rails, suitable for Light Traffic and Temporary Lines.



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LIST OF PARTS.

1 Point Rail,	...	...	P
1 Splice Rail,	...	...	S
1 Left Wing Rail,	...	...	IW
1 Right Wing Rail.	...	...	RW
2 Guard Rails,	...	...	G
5 Crossing Blocks,	...	...	H
4 Guard Rail Blocks,	...	...	J
4 Crossing Bolts,	...	...	K
4 Guard Rail Bolts,	...	...	I
2 Splice Bolts,	...	...	F

Example of Combination of Crossings from B.H. Rails.

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From a photograph of work executed by THOS. SUMMERSON & SONS, Ltd.

Example of Combination of Crossings from B.H. Rails.

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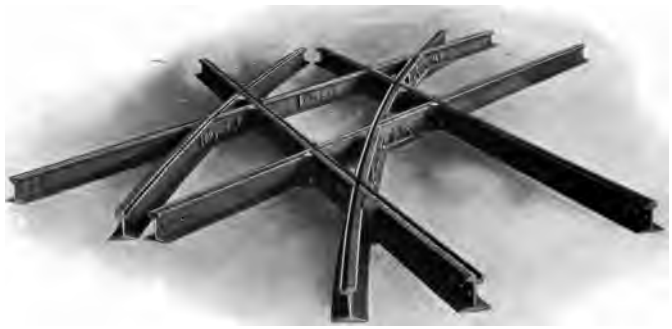
Example of Combination of Tramway Crossings from Girder Rails.



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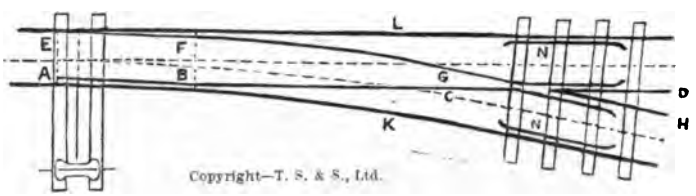
Formation of Road Bed. The road bed for a railway usually consists of 6 inches of rough broken stone in 4 to 6 in. pieces, upon which is laid the ballast, which may consist of $1\frac{1}{2}$ to 2 in. cubes of broken stone or road metal, gravel, or ashes, whichever is most readily procured in the district. The centre of the road bed formation should be several inches higher than the sides, like a turnpike, for shedding the water. The chief essential in selecting ballast is to get a material that will drain satisfactorily, and that will not readily pulverize and escape as dust. The depth of ballast under the sleepers, when hard packed, should be 4 inches at least, but 6 inches is better, to facilitate re-packing.

Platelaying. The road bed having been prepared and levelled by the Contractor, the material should be delivered in a manner to save labour. The rails should be laid down in pairs, end to end, on one side of the road bed, and the sleepers and chairs thrown down in numbers to correspond with the rails. The fish-plates, bolts, spikes, and keys should be distributed in heaps at convenient distances apart. When all the material is to hand, the work of platelaying should proceed as follows:—Space out the sleepers to a lath marked with the position of the chairs corresponding to the length of the rails. Lay the rails on the sleepers about 18 inches from the ends, lay the chairs on the sleepers inside of the rails and just touching them, tilt the rails into the chairs, bring

ends of sleepers into line, then lever the rails on one side to their correct position in respect to the ends of the sleepers and to line with same, key and single spike the chairs on this side, seeing that the rail is straight, place opposite rail to gauge, then key and single spike the chairs as before. Doubling up or putting in the additional spikes can be done by a part of the gang after a sufficient length has been laid.

Platelaying—Switches and Crossings. Having fixed the position of the crossing nose by the plan, lay down the special crossing sleepers in positions to correspond with the crossing chairs. The crossing, which should be supplied in one piece fitted up with the necessary special chairs, may then be placed in position. Next lay in the switches, their position being found by the distance **D** given in the Tables, from the nose of the crossing to heel of the points; special sleepers, as a rule are not required for switches unless the two first sleepers are lengthened to carry a lever box, which is very good practice. Switches should be laid rather tight to gauge at the toe or narrow end. The intermediate sleepers may now be dropped into

FIG. 8.



their places. If the curve is out of a straight road, couple this up first by closing **B** to **C** (See Fig. 8), then lay in rail **L** loosely. Line switch **A B** when shut with **B C** and the crossing, and single spike and key the chairs on this side—bring **L** to gauge, single spike and key up. The curved closing rail **F G** may now be laid in and curved with the jim crow to suit the crossing. Rails will require to be cut for the closing rails between **F** and **G** and **B** and **C,** unless special lengths are provided for the purpose. Give each end of crossing a nip with jim crow to adapt it to the curve, then proceed to lay in rail **K** to gauge with **F G,** easing the gauge if the curve is very sharp, in accordance with instructions for widening gauge on curves, given on page 5. The guard rails may now be keyed into their chairs. The chairs are all single-spiked at first, same as when laying plain track, and must not be doubled up or completed till the gauge has been carefully tried over the whole and any adjustments made that may be necessary. Crossings should be laid easy to the gauge at the knees and the nose, and tight for 2 or 3 feet on each side approaching these points. The gauge should never be widened at a crossing nose for easement on a sharp curve, and if widened at all within the limits of the guard rails the flangeways should be increased. (See page 6.)

When both roads are curved, close up the one with the greater radius first.

Switches and crossing sleepers should be well packed up with beater picks, especially at the heel of the switches and the crossing nose.

Fixing Lever Boxes. When fixing the Lever-box be careful to see that the weight has plenty of clearance when down, in the case of a self-acting lever, and that it falls equally on each side of the lever frame, in case of a turn-over lever. Coach screws or fang bolts should be used for fixing the lever frame in preference to spikes. Switches should have $3\frac{1}{2}$ in. to 4 in. throw at the toe, and it must be seen that there is sufficient flangeway clearance at the set where the planing ends. If the lever does not bring the switches home, it is better to get it to do so by easing the bolts at the heels, and well oiling the chairs, rather than by moving the weight further along the lever. Switches are apt to work rather stiffly at first, but after the chairs have worn smooth they will be found free enough to enable them to be worked with less leverage.

Platelayers' Tools. The following is a list of what constitutes a complete set of Platelayers' Tools for laying D.H. or B.H. rails on wood sleepers with cast-iron chairs, for a gang of eight men :—

1 Ratchet Brace, with key for same, and half-a-dozen drills.
1 Wrought-iron Cramp for same.
2 Screw Rail Lifters.
1 Rail Bender (Jim Crow) and Lever.
4 Keying Hammers.
1 Oil Feeder.
1 Hand Hammer.

2 Cold Chisels.
6 Rodded Chisels.
2 Beater Picks.
1 Hammer Adze.
1 Small Axe.
1 Sledge Hammer, 8 lbs.
2 Auger Braces and Bits.
2 Claw-ended Crowbars.
6 Plain-ended Crowbars.
4 Pinch Bars.
2 Disc Signals.
2 Flag Signals.
2 Screw Keys.
1 Shifting Spanner.
6 Steel Shovels.
4 Steel Spades.
2 Rail Forks.
1 Graduated Spirit Level, for fixing super-elevation of outer rail on curves.
1 Road Gauge.
1 Footway Gauge.
1 Straight-edge.
1 T-Square.
1 Lifting Board and Sights.
1 10-in. Spirit Level.
1 Flat Bastard File
1 Three-square File.
1 Metallic Wired Measuring Tape.
1 Large Box, to contain the above tools, with padlocked lid.
1 Trolley.

For laying flange rails without chairs, the same tools are wanted, except the keying hammers, for which spiking hammers must be substituted.

Standard Main Line Dimensions, 4 ft. 8½ in. Gauge.

RAILS 75 TO 95 LBS. PER YARD.

Flangeway clearance, 1¾ in. to 1⅞ in., according to thickness of flange (see page 6).

Vertical flangeway clearance from top of rails, 1½ in. to 1¾ in.

Travel of switch points at end 3½ in. to 4 in.

Tilt, or inclination of rail inwards, and cone of wheels, 1 in 20, and sometimes 1 in 24.

Footway, or distance between lines of way inside of rail heads (see Board of Trade Regulations, page 45).

Sleepers, 9 ft. × 10 in. × 5 in., creosoted.

Crossing sleepers, 12 ft. to 14 ft. × 12 in. × 6 in. to 14 in. × 7 in., creosoted.

Sleepers (intermediate), centre and centre, 2 ft. 6 in. to 3 ft.

Sleepers (joint), centre and centre, 2 ft. 3 in. to 2 ft. 6 in.

The minimum distance between the two lines of way to allow trucks to clear, 3 ft. 9 in.

Minimum depth of ballast below sleepers, 4 in.

Size of spikes, 6 in. × ⅞ in.

Clearance between rail ends to allow for expansion when laid in cold weather, $\frac{3}{16}$ in.

Minimum width of wheel tyre that will safely run over a crossing, 4 in.

On wagons for sidings, minimum width of tyres, $4\frac{1}{2}$ in.;
and on engines and wagons for main line, 5 in.
Wheel flange should not exceed in depth $1\frac{1}{4}$ in.
Back and back of wheels, 4 ft. $5\frac{1}{2}$ in.
Thickness of wheel flanges, $1\frac{1}{8}$ in.
Clearance between wheel flanges and rails, $\frac{3}{8}$ in.

Useful Memoranda. For fast and heavy traffic, whether a bull-head or a flange rail is used, chairs should come between the rails and the sleepers, not only to get a better fastening, but to distribute the weight over a greater area and save the sleepers. A bull-head rail in a cast-iron chair held by a wood key has much to recommend it, and seeing that the cast iron as scrap brings about five-eighths of its original cost when the road is relaid it is not so expensive as would at first sight appear. The keys should be of oak or elm in length 3 or 4 ins. in excess of the width of the chair jaw and tapered 1 in 30. If the keys are compressed, fir may be used, and the length reduced to 2 or 3 ins. in excess of the jaw width. Compressed keys may be parallel or with but slight taper.

One objection to the bull-head section is that the metal in the bottom head is not so economically distributed for withstanding transverse strain as in the flange section. The weak point in permanent way made with flange rails used to be the cutting away of the flanges on the stock rails for the switches, but in the best practice this is now avoided. Cast-iron chairs are just as applicable to flange rails as to bull-head, but owing to the large space to be

filled wood keys are not so suitable. In any case flange rails are best held down by their flanges. Coach screws, having large heads impinging on the rail flange at one side and the chair on the other, make a satisfactory fastening if honestly screwed into holes sufficiently small; the screws should have deeply cut buttress threads. Another method is to key the rails into cast-iron chairs with steel keys, same as used in connection with steel sleepers, spiking the chairs independently to the sleepers. Rolled or stamped iron or steel is more generally used for chairs of the above type, and, being much lighter, the cost each compares favourably with cast iron, especially for large quantities. In every case the chair should hold the rail sideways, thus taking lateral strain off the fastenings.

For works' sidings and temporary roads flange rails are very generally used, dogged direct to sleepers, with fairly satisfactory results, but we should hesitate to recommend this plan for any large system of important sidings with constant traffic, for although the first cost is low, maintenance will be found high, and when roads laid in this manner get out of repair they are difficult to put right again. Flange rails spiked direct to the sleepers have no tilt, therefore, the usual coned tyres bear only on the inside edge, under these conditions locomotives are apt to slip because of the small adhesive surface, and this trouble will last till the rails have become worn down to the same angle as the tyres. To tilt flange rails a properly designed chair or sole plate

must be used. Holding down rails by fastenings through holes in the flanges is not good practice for it weakens the rails essentially.

In planning sidings the main lines which take the greatest weight of traffic should have first consideration, these should be made as straight as practicable even at the expense of excessively sharp curves in other places where the traffic is light.

Tilting the rails, and coning the wheels to suit, is of questionable utility. The object is to give ease when rounding curves ; but to set against this is the loss of adhesion and additional wear and tear, due to slip, for the peripheral speed of the wheel is different at every point in the width of the tread. It is, however, claimed in its favour that it saves the wear of the wheel flanges. It is notable that in the United States, where coning is reduced to a minimum, the adhesive power of locomotives, weight for weight, is greater than in England, where the practice is to give an inclination of 1 in 20.

The less the surface of a rail is interfered with the better, and notching should be avoided as much as possible.

Chairs should have either two spikes and two trenails or three spikes on curves ; trenails, being a tight fit in the chair holes, prevent lateral movement. A trenail bored and a spike driven through the centre is good practice. Two spikes, as a rule, are sufficient for each chair on straight road.

There is little or no advantage in jagging or twisting spikes. One of the best forms consists of

a round parallel shank swelled in the neck to fairly fill the tapered chair hole, and bevelled slightly at the point to facilitate driving.

Sleepers, except for temporary work, should be creosoted with 8 to 10 lbs. of creosote oil per cubic foot. There is a difference in the practice of engineers in regard to which side of the sleeper should be laid uppermost, but the sawn or heart side affords the best seat for the chairs, and for this reason, and to save the cost of adzing, it is perhaps most favoured.

Old spike holes in sleepers should be filled by oak trenails, tarred and driven tight.

Spike holes should be bored right through the sleeper, about $\frac{1}{8}$ in. less than the diameter of the shank of the spike.

Diamond crossings, on the 4 ft. $8\frac{1}{2}$ in. gauge, should not be put in of a more acute angle than 1 in 8 for main line work, and a limit of 1 in 6 is to be recommended.

In places where there is a tendency for couplings to catch in the Vees of crossings, these should be fitted with blocks of wood between the rails; and where horse haulage is used, the open ends of guard rails should be protected by pieces of wood nailed to the sleepers in addition to the above.

The buffers of long trucks, with 14 to 15 ft. rigid wheel base, are apt to interlock on curves below 100 ft. radius on the 4 ft. $8\frac{1}{2}$ in. gauge.

Self-acting gradients for colliery sidings should be made 1 in 75 for loaded trucks, and 1 in 65 where the trucks are required to start alone for weighing from near and far in all weather.

BOARD OF TRADE REQUIREMENTS.
B.

BLOCK TELEGRAPH.

1. The requisite apparatus for providing by means of the Block Telegraph system an adequate interval of space between following trains, and, in the case of junctions, between converging or crossing trains. In the case of single lines worked by one engine under steam (or two or more coupled together) carrying a staff, no such apparatus will be required.

SIGNALS.

2. Home-signals and distant-signals for each direction to be fixed at stations and junctions, with extra signals for such dock or bay lines as are used either for the arrival or for the departure of trains, and starting signals for each direction at all passenger stations which are also block posts. On passenger lines all cross-over roads and all connexions for goods or mineral lines and sidings to be protected by home and distant signals, and as a rule at all important running junctions, a separate distant-signal to be provided in connexion with each home-signal.

Signals may be dispensed with on single lines under the following conditions:—

(a) *At all stations and siding connexions upon a line worked by one engine only (or two engines coupled together) carrying a staff, and when all points are locked by such staff.*

(b) *At any intermediate siding connexion upon a line worked under the train staff and ticket system, or under the electric staff or tablet system, where the points are locked by the staff or tablet.*

(c) *At intermediate stations, which are not staff or tablet stations, upon a line worked under the* Electric Staff or Tablet System: *Sidings, if any, being locked as in* (b).

3. The signals at junctions to be on separate posts or on brackets; and the signals at stations, where there is more than one arm on one side of a post, to be made to apply,—the first or upper arm to the line on the left, the second arm to the line next in order from the left, and so on; but in cases where the main or more important line is not the one on the left, separate signal posts to be provided, or the arms to be on brackets. Distant-signals to be distinguished by notches cut out of the ends of the arms, and to be controlled by home or starting signals for the same direction, when on the same post. A distant-signal arm must not be placed above a home or starting signal arm on the same post for trains going in the same direction.

In the case of sidings, a low short arm and a small signal light, distinguishable from the arms or lights for the passenger lines, may be employed, but in such cases disc signals are as a rule, preferable.

Every signal arm to be so weighted as to fly to and remain at danger on the breaking at any point of the connection between the arm and the lever working it.

4. On new lines worked independently, the front signal lights to be green for all right, and red for danger; the back lights (visible only when the signals are at danger) to be white.

This requirement not to be obligatory in the case of new lines run over by trains of other companies using a different system of lights.

POINTS.

5. Facing points to be avoided as far as possible, but when they cannot be dispensed with, they must be placed as near as practicable to the levers by which they are worked or bolted. The limit of distance from levers working points to be 180 yards in the case of facing-points, and 300 yards in the case of trailing-points on the main line, or safety-points of sidings.

In order to ensure that the points are in their proper position before the signals are lowered, and to prevent the signalman from shifting them while a train is passing over them, all facing-points

must be fitted with facing-point locks and locking bars, and with means for detecting any failure in the connexions between the signal-cabin and points. The length of the locking bars to exceed the greatest wheel-base between any two pairs of wheels of the vehicles in use on the line, and the stock rails to be tied to gauge with iron or steel ties. All points, whether facing or trailing, to be worked or bolted by rods, and not by wires, and to be fitted with double connecting rods.

INTERLOCKING.

6. The levers by which points and signals are worked to be interlocked and, as a rule, brought close together, into the position most convenient for the person working them, in a signal-cabin, or on a properly constructed stage. The signal-cabin to be commodius, and to be supplied with a clock and with a separate block instrument for signalling trains on each line of rails. The point-levers and signal-levers to be so placed in the cabin that the signalman when working them shall have the best possible view of the railway, and the cabin itself to be so situated as to enable the signalman to see the arms and the lights of the signals, and the working of the points. The back lights of the signal lamps to be made as small as possible, having regard to efficiency, and when the front lights are visible to the signalman in his cabin no back lights to be provided. The fixed lights in the signal cabin to be screened off, so as not to be mistakable for the signals exhibited to control the running of trains. If, from any, unavoidable cause, the arm and light of any signal cannot be seen by the signalman, they must as a rule, be repeated in the cabin.

7. The interlocking to be so arranged that the signalman shall be unable to lower a signal for the approach of a train until after he has set the points in the proper position for it to pass; that it shall not be possible for him to exhibit at the same moment any two signals that can lead to a collision between two trains; and that, after having lowered the signals to allow a train to pass, he shall not be able to move any points connected with, or leading to the line on which the train is moving. Points also, if possible, to be so interlocked as to avoid the risk of a collision.

Home or starting signals, next in advance of trailing-points, when lowered, to lock such points in either position, unless such locking will unduly interfere with the traffic.

A distant-signal must not be capable of being lowered unless the home and starting signals in advance of it have been lowered.

Sidings.

8. Sidings to be so arranged that shunting operations upon them shall cause the least possible obstruction to the passenger lines. Safety points to be provided upon goods and mineral lines and sidings, at their junctions with passenger lines, with the points closed against the passenger lines and interlocked with the signals.

Junctions.

9. When a junction is situated near to a passenger station, the platforms to be so arranged as to prevent, as far as possible, any necessity for standing trains on the junction.

10. The junctions of all single lines to be, as a rule, formed as double-line junctions.

Stations.

11. The lines of railway leading to the passenger platforms to be arranged so that the engines shall always be in front of the passenger trains as they arrive at and depart from a station; and so that, in the case of double lines or of passing places on single lines, each line shall have its own platform. At terminal stations a double line of railway must not end as a single line.

12. Platforms to be continuous, and not less than 6 feet wide for stations of small traffic, nor less than 12 feet wide for important stations; the descents at the ends of the platforms to be by ramps, and not by steps. Pillars, for the support of roofs and other fixed works, not to be less than 6 feet from the edges of the platforms. The height of the platforms above rail level to be 3 feet, save under exceptional circumstances, and in no case less than 2 feet 6 inches. The edges of the platforms to overhang not less than 12 inches. As little space as possible to be left between the edges

of the platforms and those of the footboards on the carriages. Shelter to be provided on every platform and conveniences where necessary. Names of stations to be shown on boards and on the platform lamps.

13. When stations are placed on or near a viaduct or bridge under the railway, a parapet or fence on each side to be provided of sufficient height to prevent passengers, who may by mistake leave the carriages when not at the platform, from falling from the viaduct or bridge in the dark.

14. Foot-bridges or subways to be provided for passengers to cross the railway at all exchange and other important stations. Staircases or ramps leading to or from platforms to be at no point narrower than at the top, and the available width to be in no case contracted by any erection or fixed obstruction whatever below the top.

At all stations where crowding may be expected, the staircases or ramps to be of ample width, and barriers for regulating the entrance of the crowd at the top to be erected. If in such cases there are gates at the bottom, a speaking tube or other means of communication between the top and bottom to be provided; and in all cases gates at the bottom of a staircase or ramp to open outwards. For closing the openings at the top sliding bars or gates are considered best.

The steps of staircases to be never less than 11 inches in the tread, nor more than 7 inches in the rise, and midway landings to be provided where the height exceeds 10 feet.

Efficient handrails to be provided on both staircases and ramps, and in subways, where ramps are used, the inclination not to exceed 1 in 8.

15. A clock to be provided at every station, in some conspicuous position visible from the platforms.

Stations or Sidings on Gradients.

16. No station to be constructed, and no siding to join a passenger line, on a steeper gradient than 1 in 260, except where

it is unavoidable. When the line is double, and the gradient at a station or siding junction is necessarily steeper than 1 in 260, and when danger is to be apprehended from vehicles running back, a catch-siding with points weighted for the siding, or a throw-off switch, to be provided to intercept runaway vehicles, at a distance, outside the home signal for the ascending line, greater than the length of the longest train running upon the line.

Under similar circumstances, when the line is single, provision for averting danger from runaway vehicles to be made—

(1) At a station in one of the following manners :—

a. A second line to be laid down, a second platform to be constructed, and a catch-siding or throw-off switch to be provided on the ascending line inside the loop points.

b. A loop line to be constructed lower down the incline than the station platform, with a similarly placed catch-siding or throw-off switch.

(2) At a siding junction, in one of the following manners—except where it is possible to work the traffic with the engine at the lower end of a goods or mineral train, in which case an undertaking (see No. 35) to do so, given by the company, will be accepted as sufficient :—

a. A similar loop to be constructed as in the case of a station.

b. Means to be provided for placing the whole train on sidings clear of the main line before any shunting operations are commenced.

Turntables.

17. Engine-turntables of sufficient diameter to enable the longest engines and tenders in use on the line to be turned without being uncoupled, to be erected at terminal stations, and at junctions and other places at which the engines require to be turned, except in cases of short lines not exceeding 15 miles in

length, where the stations are not at a greater distance than three miles apart, and the Railway Company gives an undertaking (see No. 35) to stop all trains at all stations. Care to be taken to keep all turntables at safe distances from the adjacent lines of rails, so that engines, wagons, or carriages, when being turned, may not foul other lines, or endanger the traffic upon them.

Bridges and Viaducts.

18. Cast-iron must not be used for railway under-bridges, except in the form of arch-ribbed girders, where the material is in compression.

In a cast-iron arched bridge, or in the cast-iron girders of an over-bridge, the breaking weight of the girders not to be less than three times the permanent load due to the weight of the superstructure, added to six itmes the greatest moving load that can be brought upon it.

In a wrought-iron or steel bridge the greatest load which can be brought upon it, added to the weight of the superstructure, not to produce a greater strain per square inch on any part of the material than five tons where wrought iron is used, or six tons and a-half where steel is used.

The Engineer responsible for any steel structure to forward to the Board of Trade a certificate to the effect that the steel employed is either cast steel or steel made by some process of fusion, subsequently rolled or hammered, and of a quality possessing considerable toughness and ductility, together with a statement of all the tests to which it has been subjected.

19. In cases where bridges or viaducts are constructed wholly or partially of timber, a sufficient factor of safety depending on the nature and quality of the timber, to be provided for.

N.B.—The heaviest engines, boiler trucks, or travelling cranes in use on railways afford a measure of the greatest moving loads to

which a bridge can be subjected. The above rules apply equally to the main and transverse girders and rail bearers.

20. It is desirable that viaducts should, as far as possible, be wholly constructed of brick or stone, and in such cases they must have parapet walls on each side, not under 4 feet 6 inches in height above the rail level and not less than 18 inches thick.

Where it is not practicable to construct the viaducts of brick or stone, and iron or steel girders are made use of, it is considered best that in important viaducts the permanent way should be laid between the main girders. In all cases substantial parapets with a height of not less than four feet 6 inches above rail level must be provided by an addition to the girders, unless the girders themselves are sufficiently high. On important viaducts where the superstructure is of iron, steel, or timber, substantial outside wheel guards to be fixed, above the level of and as close to the outer rails as possible, but not so as to be liable to be struck by any part of an engine or train running on the rails.

In the construction of the abutments or piers which support the girders of high bridges and viaducts, cast-iron columns of small size must not be used.

In all large structures a wind pressure of 56 lbs. per square foot to be assumed for the purpose of calculation, which will be based on the rules laid down on the report, dated 20th May, 1881, of the Committee appointed by the Board of Trade to consider the question of wind pressure on railway structures.

21. The upper surfaces of the wooden platforms of bridges and viaducts to be protected from fire.

22. All castings for use in railway structures to be, where practicable, cast in a similar position to that which they are intended to occupy when fixed.

Permanent Way.

23. The joints of rails to be secured by means of fishplates, or by some other equally secure fastening. On main lines and lines where heavy traffic may be worked at high speed, the chairs not to weigh less than 40 lbs., but on branch lines or lines on which the traffic is light, chairs weighing not less than 30 lbs. may be used.

24. When chairs are used to support the rails they must be secured to the sleepers, at least partially, by iron spikes or bolts. With flat-bottom rails, when there are no chairs, or with bridge rails, the fastenings at the joints, and at some intermediate places, to consist of fang or other through-bolts; and such rails, on curves with radii of 15 chains or less, to be tied to gauge by iron or steel ties at suitable intervals.

25. In any curve where the radius is 10 chains or less, a check rail to be provided.

26. Diamond crossing, as a rule, not to be flatter than 1 in 8.

Width of Line.

27. No standing work (other than a passenger platform) to be nearer to the side of the widest carriage in use on the line than 2 feet 4 inches, at any point between the level of 2 feet 6 inches above the rails and the level of the upper parts of the highest carriage doors. This applies to all arches, abutments, piers, supports, girders, tunnels, bridges, roofs, walls, posts, tanks, signals, fences, and other works, and to all projections at the side of a railway constructed to any gauge.

Intervals between Lines.

28. The intervals between adjacent lines of rails, where there are two lines only, or between lines of rails and sidings, not to be less than 6 feet. Where additional running lines of rails are alongside the main lines, an interval of not less than 9 feet 6 inches

to be provided, if possible, between such additional lines and the main lines.

Level Crossings.

29. At all level crossings of public roads the gates to be so constructed that they may be closed either across the railway or across the road at each side of the crossing, and a lodge, or in the case of a station, a gate-keeper's box, to be provided, unless the gates are worked from a signal-cabin. The gates must not be capable of being opened at the same time for the road and the railway, and must be so hung as not to admit of being opened outwards towards the road. Stops to be provided to keep the gates in position across the road or railway. Wooden gates are considered preferable to iron gates, and single gates on each side to double gates. Red discs or targets must be fixed on the gates, with lamps for night use; and semaphore signals in one or both directions interlocked with the gates may be required. At all level crossings of public roads or footpaths a footbridge or a subway may be required.

At occupation and field crossings the gates must be hung so as to open outwards from the line.

30. Sidings connected with the main lines near a public road level crossing to be so placed that shunting may be carried on with as little interference as possible with the level crossing; and, as a rule, the points of the sidings to be not less than 100 yards from the crossing.

31. At public road level crossings in or near populous places the lower portions of the gates to be either close barred or covered with wire netting.

Mile Posts, &c.

32. Mile posts, half-mile and quarter-mile posts, and gradient-boards to be provided along the line.

Platelayers' Refuges, &c.

33. Tunnels and long viaducts to be in all cases constructed with refuges for the safety of platelayers. On under-bridges

without parapets, handrails to be provided. Viaducts of steel, iron, or timber to be provided with manholes or other facilities for inspection.

Continuous Brakes.

34. Continuous brakes (in accordance with the Regulation of Railways Act of 1889), complying with the following requirements, to be provided on all trains carrying passengers, viz. :—

(1.) The brake must be instantaneous in action and capable of being applied by the engine-driver and guards ;

(2.) The brake must be self-applying in the event of any failure in the continuity of its action ;

(3.) The brake must be capable of being applied to every vehicle of the train, whether carrying passengers or not ;

(4.) The brake must be in regular use in daily working ;

(5.) The materials of the brake must be of a durable character, and easily maintained and kept in order.

35. Any undertaking furnished by a Railway Company to be under the seal, and signed by the Chairman and Secretary of the Company.

MEMO.

TABLES AND DIAGRAMS,

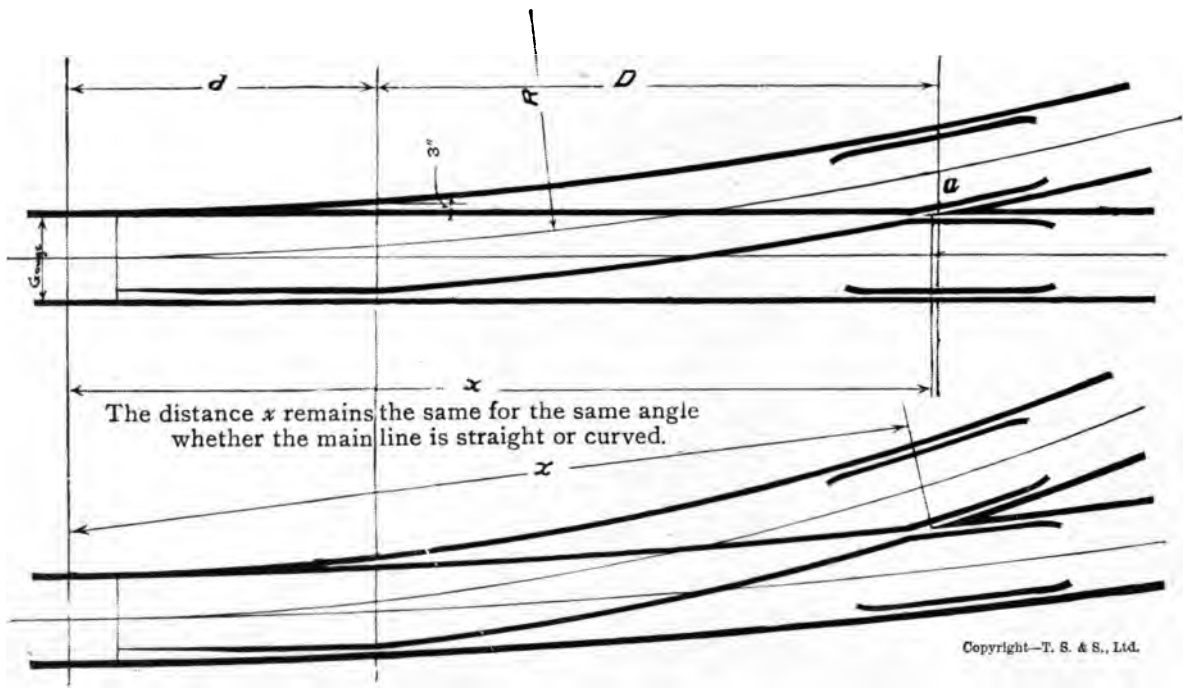
CONTAINING

TABLES FOR THE FOLLOWING GAUGES :—

1 FT. 6 IN., 2 FT., 2 FT. 6 IN., 3 FT., 3 FT. $3\frac{3}{8}$ IN. (METRE),
3 FT. 6 IN., 4 FT. $8\frac{1}{2}$ IN., 5 FT. 3 IN., AND 5 FT. 6 IN.,

REFERRING TO

DIAGRAMS FOR SINGLE JUNCTIONS, DOUBLE JUNCTIONS,
THREE THROWS, SINGLE CROSS-OVERS,
DOUBLE CROSS-OVERS, DIAMONDS WITH SINGLE SLIPS,
AND DIAMONDS WITH DOUBLE SLIPS.



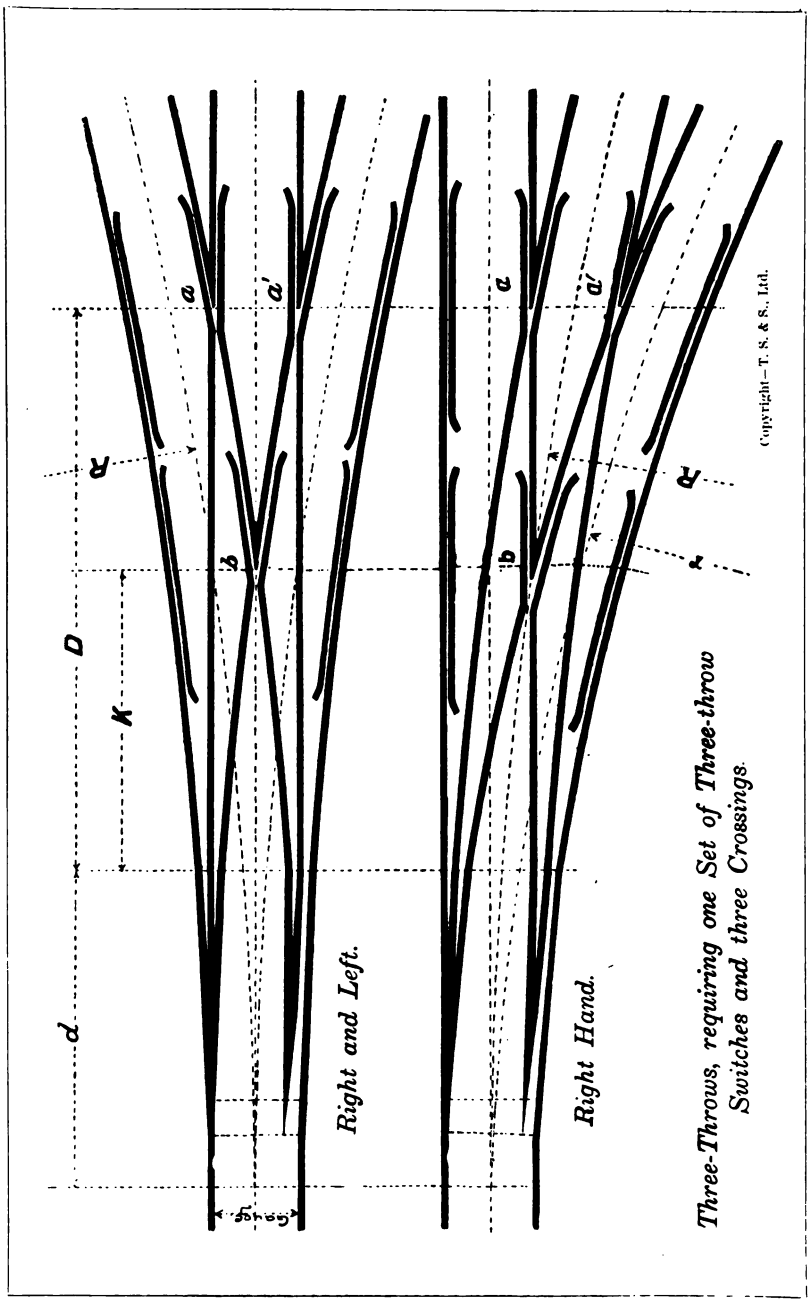
Single Junction requiring one Set of Switches and Crossings.

1 ft. 6 in. Gauge. Diagram No. 1.

SINGLE JUNCTIONS.

1 ft. 6 in. Gauge. Table No. 1.

Angle of Crossing. a In Units.	Angle of Crossing. a In Degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	x Spring of Curve to intersection of Gauge Lines.	Radius of Curve. R	Angle of Crossing. a In Units.	Angle of Crossing. a In Degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	x Spring of Curve to intersection of Gauge Lines.	Radius of Curve. R
1 in 1¾	Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	1 in 7½	Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 ,, 2	31 52	2 1½	3 2	5 3	9 3	1 ,, 8	7 38	9 2	13 6	22 6	169 0
1 ,, 2¼	28 4	2 5¼	3 7¾	6 0	12 0	1 ,, 8½	7 10	9 9	14 5	24 0	192 0
1 ,, 2½	25 4	2 9	4 0½	6 9	15 3	1 ,, 9	6 44	10 5	15 3	25 6	217 0
1 ,, 2¾	22 38	3 0½	4 6	7 6	18 9	1 ,, 9½	6 22	11 0	16 2	27 0	243 0
1 ,, 3	20 36	3 4¼	4 11½	8 3	22 9	1 ,, 10	6 2	11 7	17 1	28 6	271 0
1 ,, 3¼	18 54	3 8	5 4¾	9 0	27 0	1 ,, 10½	5 44	12 3	18 0	30 0	300 0
1 ,, 3½	17 26	3 11½	5 10¼	9 9	32 0	1 ,, 10½	5 26	12 10	18 11	31 6	331 0
1 ,, 3¾	16 16	4 3	6 3½	10 6	37 0	1 ,, 11	5 12	13 5	19 10	33 0	363 0
1 ,, 4	15 12	4 7	6 9	11 3	42 6	1 ,, 11½	4 58	14 1	20 8	34 6	397 0
1 ,, 4¼	14 14	4 10¾	7 2¼	12 0	48 0	1 ,, 12	4 46	14 8	21 7	36 0	432 0
1 ,, 4½	13 26	5 2	7 8	12 9	54 6	1 ,, 12½	4 36	15 3	22 6	37 6	469 0
1 ,, 4¾	12 40	5 6	8 1	13 6	61 0	1 ,, 13	4 24	15 11	23 5	39 0	507 0
1 ,, 4¾	12 2	5 10	8 6½	14 3	68 0	1 ,, 14	4 6	17 2	25 2	42 0	588 0
1 ,, 5	11 26	6 1½	9 0	15 0	75 0	1 ,, 15	3 50	18 4	27 0	45 0	675 0
1 ,, 5½	10 24	6 8½	9 11	16 6	91 0	1 ,, 16	3 34	19 7	28 9	48 0	768 0
1 ,, 6	9 32	7 4	10 9½	18 0	108 0	1 ,, 17	3 22	20 9	30 7	51 0	867 0
1 ,, 6½	8 48	7 11	11 8½	19 6	127 0	1 ,, 18	3 10	22 0	32 4	54 0	972 0
1 ,, 7	8 10	8 7	12 7	21 0	147 0						


1 ft. 6 in. Gauge. Diagram No. 2.
a
a'
b
D
K
d
R
Right and Left.
Right Hand.
Three-Throws, requiring one Set of Three-throw Switches and three Crossings.
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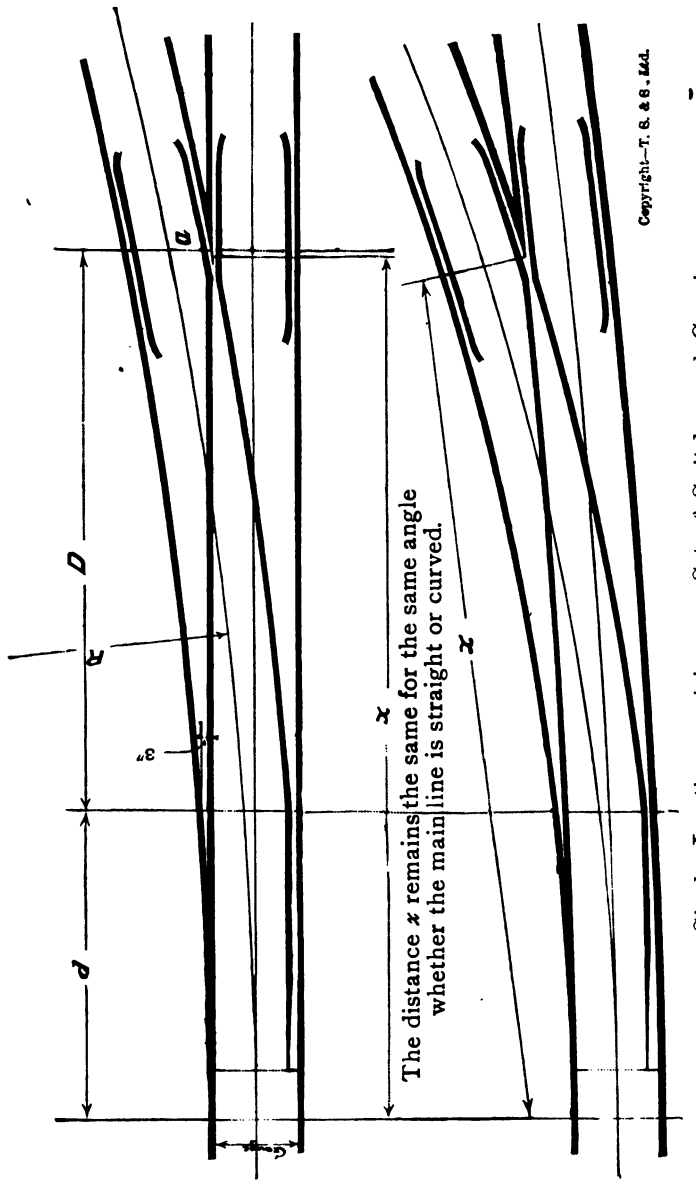
THREE THROWS.

1 ft. 6 in. Gauge. Table No. 2.

Angle of Crossings. a a1	Angle of Crossing. b	Spring of Curve to Heel of Switches. d	Heel of Switches to Nose of Crossings. D	Heel of Switches to Nose of Crossing. K	Radius of Inside Curve. r	Radius of Curve. R	Angle of Crossings. a a1	Angle of Crossing. b	Spring of Curve to Heel of Switches. d	Heel of Switches to Nose of Crossings. D	Heel of Switches to Nose of Crossing. K	Radius of Inside Curve. r	Radius of Curve. R
1 in 1¾	1 in 1'21	Ft. Ins. 2 1½	Ft. Ins. 3 2	Ft. Ins. 1 8¼	Ft. Ins. 4 9	Ft. Ins. 9 3	1 in 7½	1 in 5'29	Ft. Ins. 9 2	Ft. Ins. 13 6	Ft. Ins. 6 10	Ft. Ins. 84 6	Ft. Ins. 169 0
1 „ 2	1 „ 1'39	2 5¼	3 7¾	1 11	6 0	12 0	1 „ 8	1 „ 5'65	9 9	14 5	7 4	96 0	192 0
1 „ 2¼	1 „ 1'57	2 9	4 0½	2 1½	7 9	15 3	1 „ 8½	1 „ 6'00	10 5	15 3	7 9	109 0	217 0
1 „ 2½	1 „ 1'75	3 0½	4 6	2 4	9 6	18 9	1 „ 9	1 „ 6'36	11 0	16 2	8 3	122 0	243 0
1 „ 2¾	1 „ 1'93	3 4¼	4 11½	2 6¾	11 6	22 9	1 „ 9½	1 „ 6'71	11 7	17 1	8 8	136 0	271 0
1 „ 3	1 „ 2'10	3 8	5 4¾	2 9½	13 0	27 0	1 „ 10	1 „ 7'06	12 3	18 0	9 2	150 0	300 0
1 „ 3¼	1 „ 2'28	3 11½	5 10¼	3 0	16 0	32 0	1 „ 10½	1 „ 7'42	12 10	18 11	9 7	166 0	331 0
1 „ 3½	1 „ 2'46	4 3	6 3¾	3 2¾	18 6	37 0	1 „ 11	1 „ 7'77	13 5	19 10	10 1	182 0	363 0
1 „ 3¾	1 „ 2'64	4 7	6 9	3 5½	21 3	42 6	1 „ 11½	1 „ 8'12	14 1	20 8	10 6	199 0	397 0
1 „ 4	1 „ 2'82	4 10¾	7 2¼	3 8	24 0	48 0	1 „ 12	1 „ 8'48	14 8	21 7	10 11	216 0	432 0
1 „ 4¼	1 „ 3'00	5 2	7 8	3 11	27 3	54 6	1 „ 12½	1 „ 8'84	15 3	22 6	11 5	235 0	469 0
1 „ 4½	1 „ 3'17	5 6	8 1	4 1½	30 6	61 0	1 „ 13	1 „ 9'19	15 11	23 5	11 10	254 0	507 0
1 „ 4¾	1 „ 3'34	5 10	8 6½	4 4½	34 0	68 0	1 „ 14	1 „ 9'89	17 2	25 2	12 9	294 0	588 0
1 „ 5	1 „ 3'52	6 1½	9 0	4 7	37 6	75 0	1 „ 15	1 „ 10'60	18 4	27 0	13 8	338 0	675 0
1 „ 5½	1 „ 3'88	6 8½	9 11	5 0½	46 0	91 0	1 „ 16	1 „ 11'31	19 7	28 9	14 7	384 0	768 0
1 „ 6	1 „ 4'23	7 4	10 9½	5 6	54 0	108 0	1 „ 17	1 „ 12'02	20 9	30 7	15 6	434 0	867 0
1 „ 6½	1 „ 4'58	7 11	11 8½	5 11½	63 6	127 0	1 „ 18	1 „ 12'72	22 0	32 4	16 5	486 0	972 0
1 „ 7	1 „ 4'94	8 7	12 7	6 5	73 6	147 0							



Single Junction requiring one Set of Switches and Crossings.

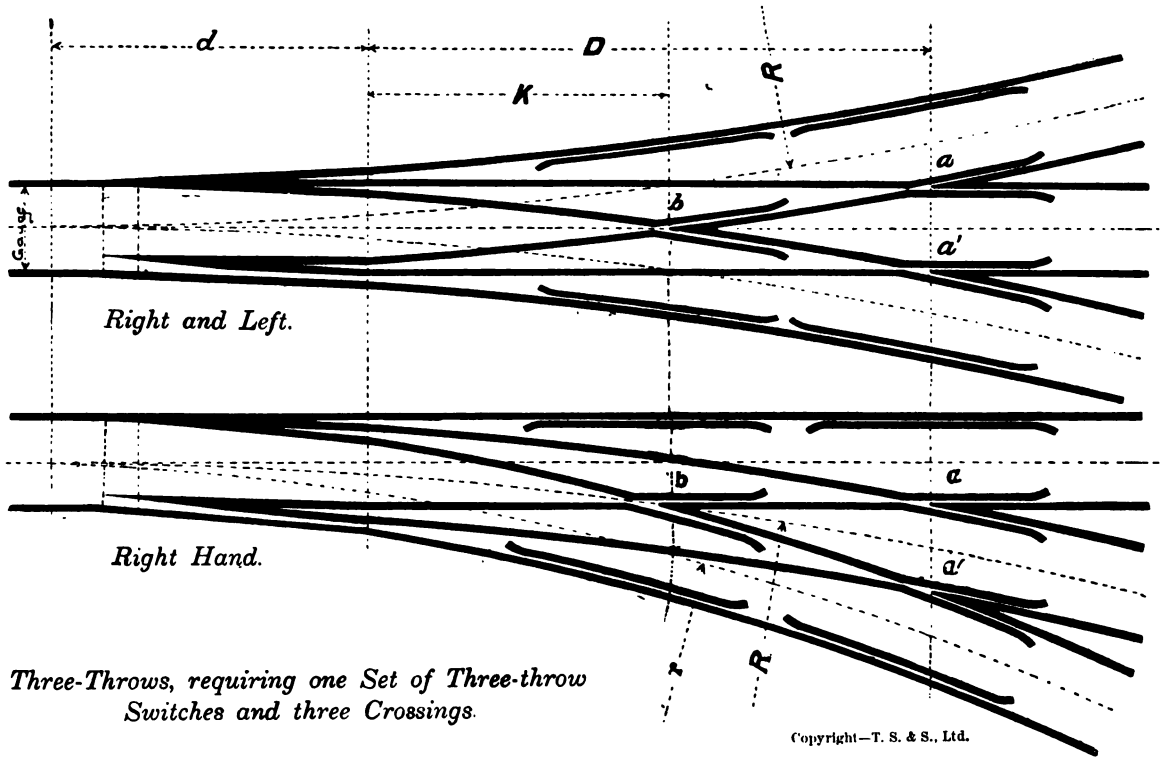
2 ft. Gauge. Diagram No. 1.

SINGLE JUNCTIONS.

2 ft. Gauge. Table No. 1.

Angle of Crossing. a In Units.	Deg.	Min.	d Spring of Curve to Heel of Switches. Ft.	Ins.	D Heel of Switches to Nose of Crossing. a Ft.	Ins.	x Spring of Curve to intersection of Gauge Lines. Ft.	Ins.	R Radius of Curve. Ft.	Ins.
1 in 1¾	31	52	2	5¼	4	7¼	7	0	12	3
1 ,, 2	28	4	2	9¾	5	2¾	8	0	16	0
1 ,, 2¼	25	4	3	2	5	10¾	9	0	20	3
1 ,, 2½	22	38	3	6¼	6	6½	10	0	25	0
1 ,, 2¾	20	36	3	10½	7	2¼	11	0	30	3
1 ,, 3	18	54	4	2¾	7	10	12	0	37	0
1 ,, 3¼	17	26	4	7	8	6	13	0	42	6
1 ,, 3½	16	16	4	11¼	9	1¾	14	0	49	0
1 ,, 3¾	15	12	5	3½	9	9½	15	0	56	6
1 ,, 4	14	14	5	7¾	10	5	16	0	64	0
1 ,, 4¼	13	26	6	0	11	1	17	0	72	6
1 ,, 4½	12	40	6	4½	11	9	18	0	81	0
1 ,, 4¾	12	2	6	8½	12	5	19	0	90	0
1 ,, 5	11	26	7	0½	13	0½	20	0	100	0
1 ,, 5½	10	24	7	9½	14	4	22	0	121	0
1 ,, 6	9	32	8	5½	15	8	24	0	144	0
1 ,, 6½	8	48	9	2	16	11½	26	0	169	0
1 ,, 7	8	10	9	10½	18	3	28	0	196	0

Angle of Crossing. a In Units.	Deg.	Min.	d Spring of Curve to Heel of Switches. Ft.	Ins.	D Heel of Switches to Nose of Crossing. a Ft.	Ins.	x Spring of Curve to intersection of Gauge Lines. Ft.	Ins.	R Radius of Curve. Ft.	Ins.
1 in 7½	7	38	10	7	19	7	30	0	225	0
1 ,, 8	7	10	11	3½	20	10½	32	0	256	0
1 ,, 8½	6	44	12	0	22	2	34	0	289	0
1 ,, 9	6	22	12	8	23	6	36	0	324	0
1 ,, 9½	6	2	13	5	24	9	38	0	361	0
1 ,, 10	5	44	14	2	26	1	40	0	400	0
1 ,, 10½	5	26	14	10	27	5	42	0	441	0
1 ,, 11	5	12	15	6	28	9	44	0	484	0
1 ,, 11½	4	58	16	3	30	0	46	0	529	0
1 ,, 12	4	46	16	11	31	4	48	0	576	0
1 ,, 12½	4	36	17	8	32	7	50	0	625	0
1 ,, 13	4	24	18	4	33	11	52	0	676	0
1 ,, 14	4	6	19	9	36	6	56	0	784	0
1 ,, 15	3	50	21	2	39	2	60	0	900	0
1 ,, 16	3	34	22	7	41	9	64	0	1024	0
1 ,, 17	3	22	24	0	44	4	68	0	1156	0
1 ,, 18	3	10	25	5	46	11	72	0	1296	0



2 ft. Gauge. Diagram No. 2.

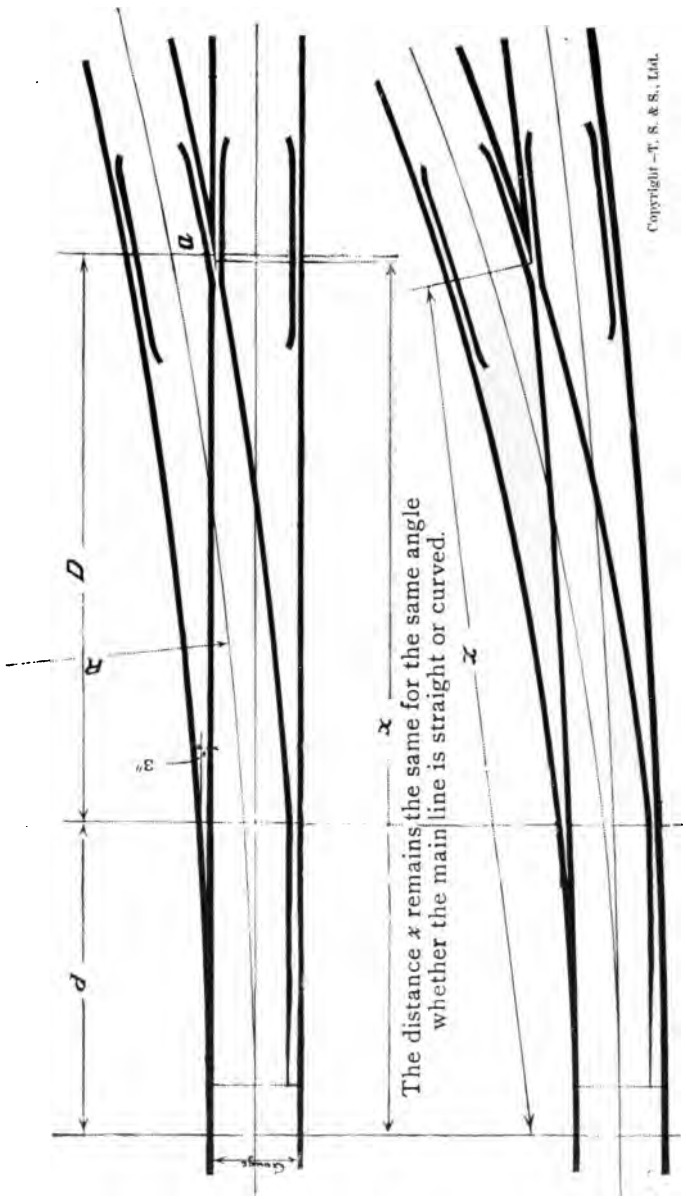
THREE THROWS.

2 ft. Gauge. Table No. 2.

Angle of Crossings. a a1	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a1	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.
1 in 14	1 in 1'21	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 ,, 2	1 ,, 1'39	2 5 1/4	4 7 1/4	2 7 1/2	6 3	12 3
1 ,, 2 1/4	1 ,, 1'57	2 9 3/4	5 2 3/4	2 11 1/4	8 0	16 0
1 ,, 2 2/4	1 ,, 1'75	3 2	5 10 3/4	3 3 3/4	10 3	20 3
1 ,, 2 3/4	1 ,, 1'93	3 6 1/4	6 6 1/4	3 8	12 6	25 0
1 ,, 3	1 ,, 2'10	3 10 1/2	7 1 3/4	4 0 1/4	15 3	30 3
1 ,, 3 1/4	1 ,, 2'28	4 2 3/4	7 10	4 4 1/4	18 6	37 0
1 ,, 3 2/4	1 ,, 2'46	4 7	8 6	4 8 1/2	21 3	42 6
1 ,, 3 3/4	1 ,, 2'64	4 11 1/4	9 1 1/4	5 0 3/4	29 6	49 0
1 ,, 4	1 ,, 2'82	5 3 1/2	9 9 1/2	5 5	28 3	56 6
1 ,, 4 1/4	1 ,, 3'00	5 7 3/4	10 5	5 9 1/4	32 0	64 0
1 ,, 4 2/4	1 ,, 3'17	6 0	11 1	6 1 1/2	36 6	72 6
1 ,, 4 3/4	1 ,, 3'34	6 4 1/4	11 9	6 5 3/4	41 0	81 0
1 ,, 5	1 ,, 3'52	6 8 1/2	12 5	6 10	45 6	90 0
1 ,, 5 1/4	1 ,, 3'88	7 0 1/2	13 0 1/2	7 2	50 0	100 0
1 ,, 5 2/4	1 ,, 4'23	7 9 1/2	14 4	7 11	60 6	121 0
1 ,, 6	1 ,, 4'58	8 5 1/2	15 8	8 7 1/2	72 0	144 0
1 ,, 6 1/2	1 ,, 4'94	9 2	16 11 1/2	9 4	84 6	169 0
1 ,, 7	1 ,, 4'94	9 10 1/2	18 3	10 0 1/2	98 0	196 0

Angle of Crossings. a a1	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a1	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.
1 in 7 1/2	1 in 5'29	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 ,, 8	1 ,, 5'65	11 3 1/2	20 10 1/2	11 5 1/2	128 0	256 0
1 ,, 8 1/2	1 ,, 6'00	12 0	22 2	12 2	145 0	289 0
1 ,, 9	1 ,, 6'36	12 8	23 6	12 11	162 0	324 0
1 ,, 9 1/2	1 ,, 6'71	13 5	24 9	13 7	181 0	361 0
1 ,, 10	1 ,, 7'06	14 2	26 1	14 4	200 0	400 0
1 ,, 10 1/2	1 ,, 7'42	14 10	27 5	15 1	221 0	441 0
1 ,, 11	1 ,, 7'77	15 6	28 9	15 9	242 0	484 0
1 ,, 11 1/2	1 ,, 8'12	16 3	30 0	16 5 1/2	265 0	529 0
1 ,, 12	1 ,, 8'48	16 11	31 4	17 2	288 0	576 0
1 ,, 12 1/2	1 ,, 8'84	17 8	32 7	17 11	313 0	625 0
1 ,, 13	1 ,, 9'19	18 4	33 11	18 7	338 0	676 0
1 ,, 14	1 ,, 9'89	19 9	36 6	20 0	392 0	784 0
1 ,, 15	1 ,, 10'60	21 2	39 2	21 6	450 0	900 0
1 ,, 16	1 ,, 11'31	22 7	41 9	22 11	512 0	1024 0
1 ,, 17	1 ,, 12'02	24 0	44 4	24 4	578 0	1156 0
1 ,, 18	1 ,, 12'72	25 5	46 11	25 9	648 0	1296 0

2 ft. 6 in. Gauge. Diagram No. 1.



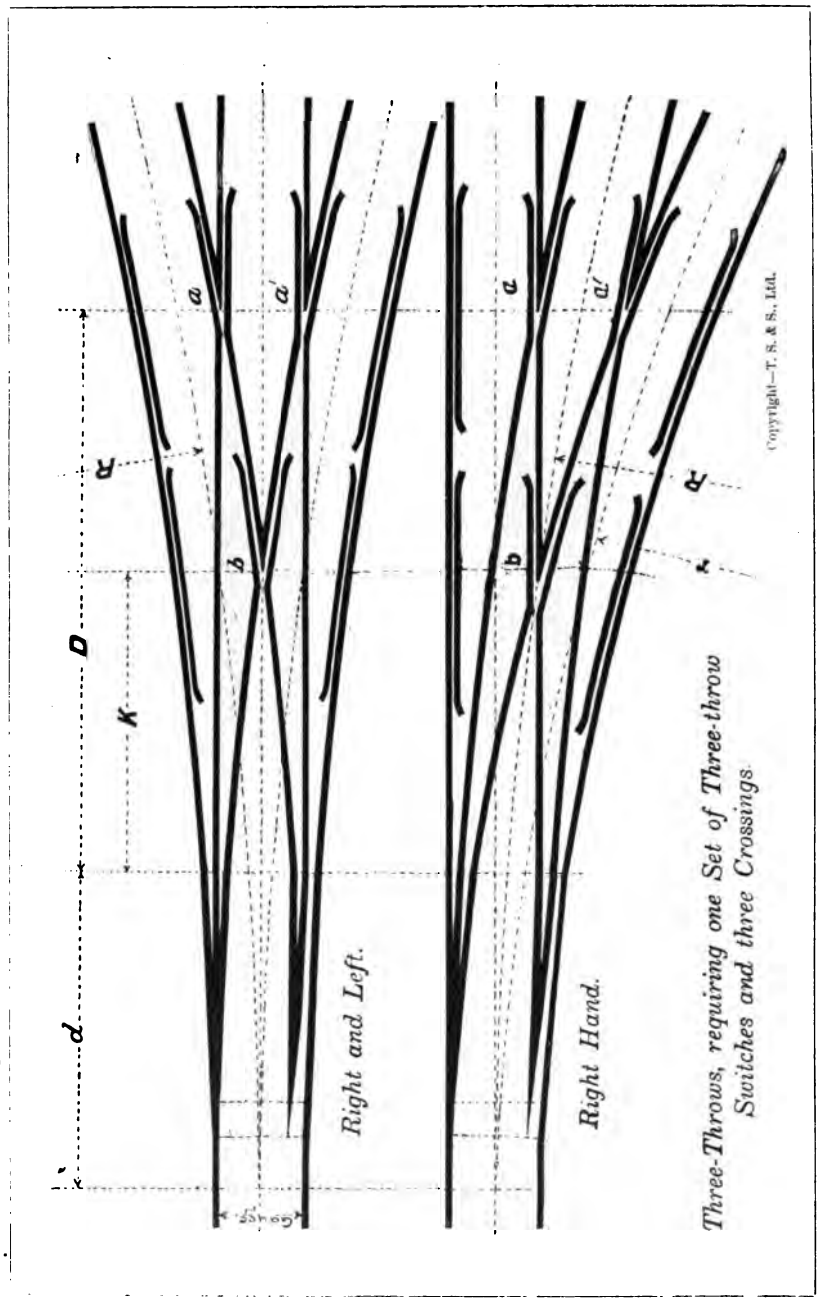
Single Junction requiring one Set of Switches and Crossings.

SINGLE JUNCTIONS.

2 ft. 6 in. Gauge. Table No. 1.

Angle of Crossing. a In Units.	Angle of Crossing. a In Degrees.	d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossing. a		x Spring of Curve to intersection of Gauge Lines.		Radius of Curve. R	
		Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 1¾	31 52	2	9	6	0¾	8	9	15	3
1 ,, 2	28 4	3	1¾	6	11	10	0	20	0
1 ,, 2¼	25 4	3	6½	7	9½	11	3	25	3
1 ,, 2½	22 38	3	11¼	8	7¾	12	6	31	6
1 ,, 2¾	20 36	4	4	9	6	13	9	38	0
1 ,, 3	18 54	4	8¾	10	4½	15	0	45	0
1 ,, 3¼	17 26	5	1½	11	2¾	16	3	53	0
1 ,, 3½	16 16	5	6¼	12	1¼	17	6	61	6
1 ,, 3¾	15 12	5	11	12	11½	18	9	70	6
1 ,, 4	14 14	6	3¾	13	9¾	20	0	80	0
1 ,, 4¼	13 26	6	8½	14	8	21	3	90	6
1 ,, 4½	12 40	7	1	15	6½	22	6	102	0
1 ,, 4¾	12 2	7	6	16	5	23	9	113	0
1 ,, 5	11 26	7	10½	17	3½	25	0	125	0
1 ,, 5½	10 24	8	8	19	0	27	6	152	0
1 ,, 6	9 32	9	5½	20	8½	30	0	180	0
1 ,, 6½	8 48	10	3	22	5½	32	6	212	0
1 ,, 7	8 10	11	0½	24	2	35	0	245	0

Angle of Crossing. a In Units.	Angle of Crossing. a In Degrees.	d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossing. a		x Spring of Curve to intersection of Gauge Lines.		Radius of Curve. R	
		Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 7½	Deg. Min. 7 38	11	10	25	11	37	6	282	0
1 ,, 8	7 10	12	7½	27	7½	40	0	320	0
1 ,, 8½	6 44	13	5	29	4	42	6	362	0
1 ,, 9	6 22	14	2	31	1	45	0	405	0
1 ,, 9½	6 2	15	0	32	10	47	6	452	0
1 ,, 10	5 44	15	9	34	7	50	0	500	0
1 ,, 10½	5 26	16	7	36	3	52	6	552	0
1 ,, 11	5 12	17	4	38	0	55	0	605	0
1 ,, 11½	4 58	18	2	39	8	57	6	662	0
1 ,, 12	4 46	18	11	41	5	60	0	720	0
1 ,, 12½	4 36	19	9	43	2	62	6	782	0
1 ,, 13	4 24	20	6	44	11	65	0	845	0
1 ,, 14	4 6	22	1	48	4	70	0	980	0
1 ,, 15	3 50	23	8	51	10	75	0	1125	0
1 ,, 16	3 34	25	3	55	3	80	0	1280	0
1 ,, 17	3 22	26	10	58	8	85	0	1445	0
1 ,, 18	3 10	28	5	62	2	90	0	1620	0


2 ft. 6 in. Gauge. Diagram No. 2.
Right and Left.
Right Hand.
Three-Throws, requiring one Set of Three-throw Switches and three Crossings.
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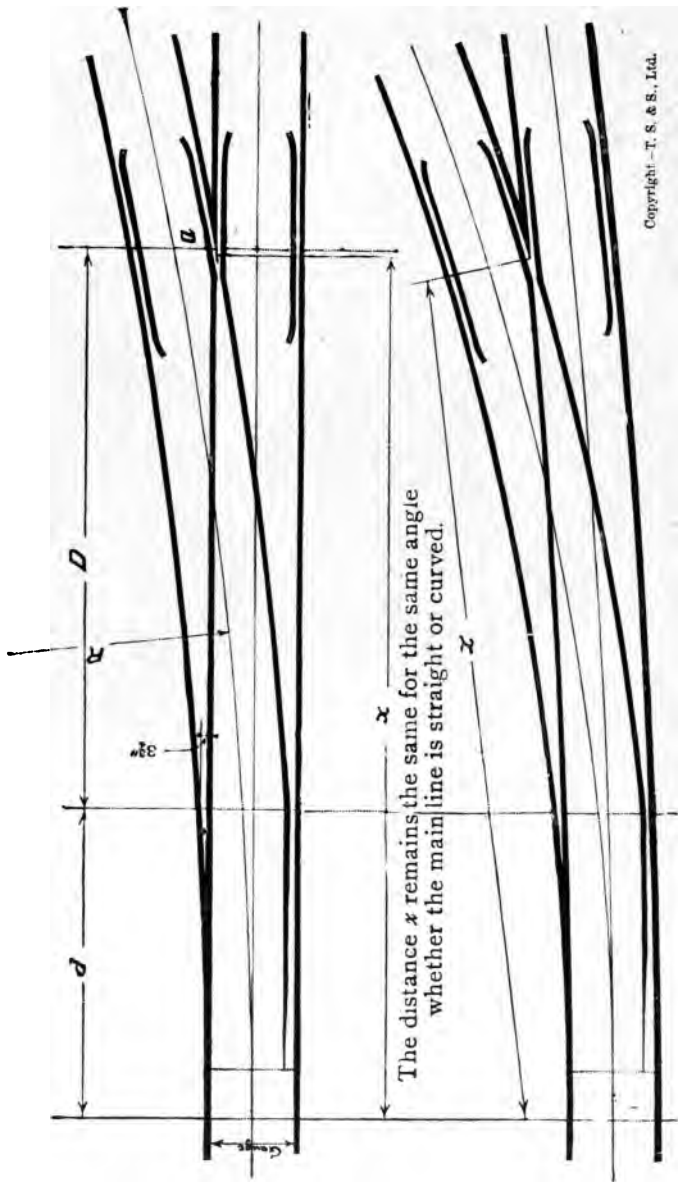
THREE THROWS.

2 ft. 6 in. Gauge. Table No. 2.

Angle of Crossings. a a¹	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a¹	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.	Angle of Crossings. a a¹	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a¹	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.
1 in 1¾	1 in 1'21	Ft. Ins. 2 9	Ft. Ins. 6 0¾	Ft. Ins. 3 7¼	Ft. Ins. 7 9	Ft. Ins. 15 3	1 in 7½	1 in 5'29	Ft. In. 11 10	Ft. In. 25 11	Ft. Ins. 14 10½	Ft. Ins. 141 0	Ft. Ins. 282 0
1 ,, 2	1 ,, 1'39	3 1¾	6 11	4 0¾	10 0	20 0	1 ,, 8	1 ,, 5'65	12 7½	27 7½	15 10½	160 0	320 0
1 ,, 2¼	1 ,, 1'57	3 6½	7 9½	4 6¾	12 9	25 3	1 ,, 8½	1 ,, 6'00	13 5	29 4	16 10	181 0	362 0
1 ,, 2½	1 ,, 1'75	3 11¼	8 7	5 0½	15 9	31 6	1 ,, 9	1 ,, 6'36	14 2	31 1	17 10	203 0	405 0
1 ,, 2¾	1 ,, 1'93	4 4	9 6	5 6½	19 0	38 0	1 ,, 9½	1 ,, 6'71	15 0	32 10	18 10	226 0	452 0
1 ,, 3	1 ,, 2'10	4 8¾	10 4½	6 0	22 6	45 0	1 ,, 10	1 ,, 7'06	15 9	34 7	19 10	250 0	500 0
1 ,, 3¼	1 ,, 2'28	5 1½	11 2¾	6 6	26 6	53 0	1 ,, 10½	1 ,, 7'42	16 7	36 3	20 9	277 0	552 0
1 ,, 3½	1 ,, 2'46	5 6¼	12 1¼	6 11¾	31 0	61 6	1 ,, 11	1 ,, 7'77	17 4	38 0	21 9	303 0	605 0
1 ,, 3¾	1 ,, 2'64	5 11	12 11½	7 5¼	35 6	70 6	1 ,, 11½	1 ,, 8'12	18 2	39 8	22 9	331 0	662 0
1 ,, 4	1 ,, 2'82	6 3¾	13 9¾	7 11½	40 0	80 0	1 ,, 12	1 ,, 8'48	18 11	41 5	23 9	360 0	720 0
1 ,, 4¼	1 ,, 3'00	6 8½	14 8	8 5½	45 6	90 6	1 ,, 12½	1 ,, 8'84	19 9	43 2	24 9	391 0	782 0
1 ,, 4½	1 ,, 3'17	7 1	15 6½	8 11½	51 0	102 0	1 ,, 13	1 ,, 9'19	20 6	44 11	25 8	423 0	845 0
1 ,, 4¾	1 ,, 3'34	7 6	16 5¼	9 5½	57 0	113 0	1 ,, 14	1 ,, 9'89	22 1	48 4	27 8	490 0	980 0
1 ,, 5	1 ,, 3'52	7 10½	17 3½	9 11½	63 0	125 0	1 ,, 15	1 ,, 10'60	23 8	51 10	29 8	563 0	1125 0
1 ,, 5½	1 ,, 3'88	8 8	19 0	10 11	76 0	152 0	1 ,, 16	1 ,, 11.31	25 3	55 3	31 8	640 0	1280 0
1 ,, 6	1 ,, 4'23	9 5½	20 8½	11 11	90 0	180 0	1 ,, 17	1 ,, 12'02	26 10	58 8	33 7	723 0	1445 0
1 ,, 6½	1 ,, 4 58	10 3	22 5½	12 11	106 0	212 0	1 ,, 18	1 ,, 12'72	28 5	62 2	35 7	810 0	1620 0
1 ,, 7	1 ,, 4'94	11 0½	24 2	13 10½	123 0	245 0							



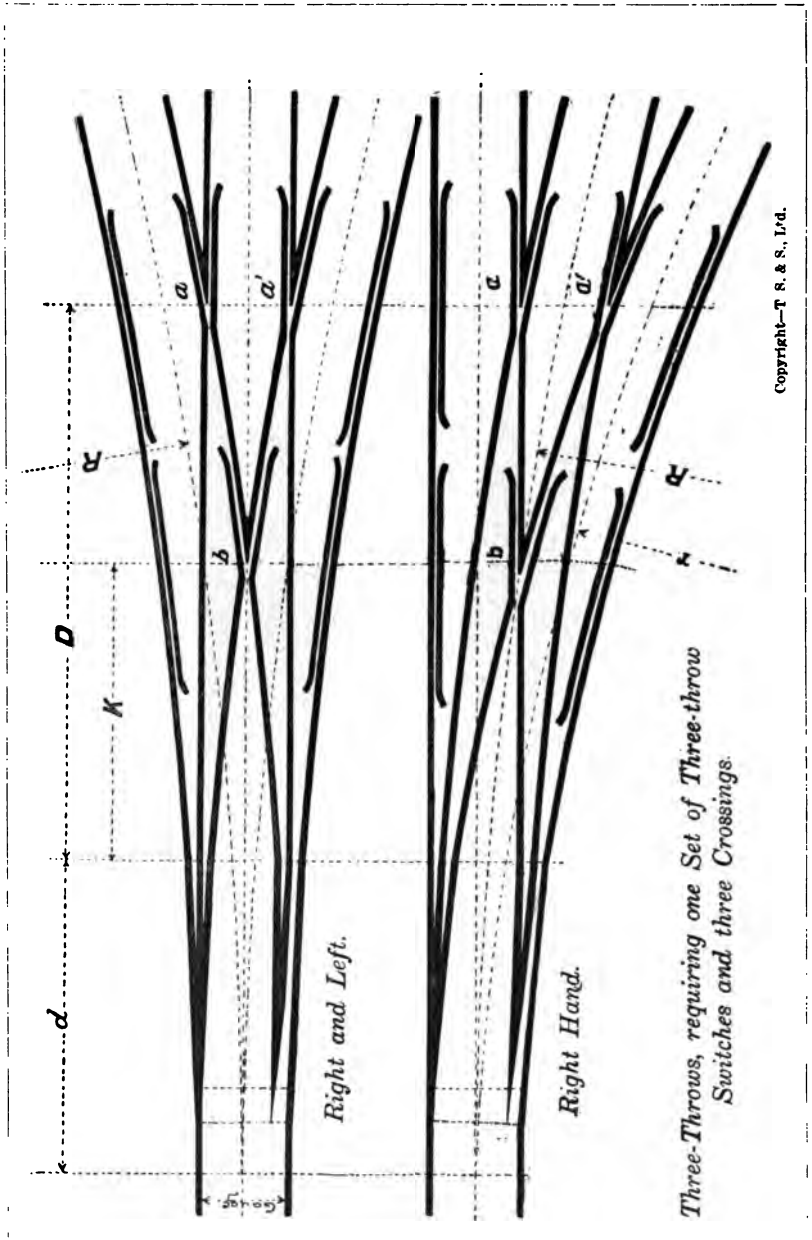
Single Junction requiring one Set of Switches and Crossings.

3 ft. Gauge. Diagram No. 1.

SINGLE JUNCTIONS.

3 ft. Gauge. Table No. 1.

Angle of Crossing. a In Units.	Angle of Crossing. a In Degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	x Spring of Curve to intersection of Gauge Lines.	R Radius of Curve.	Angle of Crossing. a In Units.	Angle of Crossing. a In Degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing. a	x Spring of Curve to intersection of Gauge Lines.	R Radius of Curve.
1 in 1¾	Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	1 in 7½	Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 ,, 2	31 52	3 4½	7 2½	10 6	18 3	1 ,, 8	7 38	14 5½	30 9½	45 0	338 0
1 ,, 2¼	28 4	3 10	8 2¾	12 0	24 0	1 ,, 8½	7 10	15 5	32 10	48 0	384 0
1 ,, 2½	25 4	4 4	9 3	13 6	30 3	1 ,, 9	6 44	16 4	34 11	51 0	434 0
1 ,, 2¾	22 38	4 9¾	10 3¼	15 0	37 6	1 ,, 9½	6 22	17 4	36 11	54 0	486 0
1 ,, 2¾	20 36	5 3½	11 3½	16 6	45 6	1 ,, 9¾	6 2	18 4	39 0	57 0	542 0
1 ,, 3	18 54	5 9¼	12 4	18 0	54 0	1 ,, 10	5 44	19 3	41 1	60 0	600 0
1 ,, 3¼	17 26	6 3	13 4¼	19 6	63 6	1 ,, 10½	5 26	20 3	43 1	63 0	662 0
1 ,, 3½	16 16	6 9	14 4½	21 0	73 6	1 ,, 11	5 12	21 2	45 2	66 0	726 0
1 ,, 3¾	15 12	7 2½	15 4¾	22 6	84 6	1 ,, 11½	4 58	22 2	47 2	69 0	794 0
1 ,, 4	14 14	7 8¼	16 5¼	24 0	96 0	1 ,, 12	4 46	23 1	49 4	72 0	864 0
1 ,, 4¼	13 26	8 2	17 6	25 6	109 0	1 ,, 12½	4 36	24 1	51 4	75 0	938 0
1 ,, 4½	12 40	8 8	18 6	27 0	121 6	1 ,, 13	4 24	25 1	53 4	78 0	1014 0
1 ,, 4¾	12 2	9 1½	19 6	28 6	136 0	1 ,, 14	4 6	27 0	57 5	84 0	1176 0
1 ,, 5	11 26	9 7½	20 6½	30 0	150 0	1 ,, 15	3 50	28 11	61 7	90 0	1350 0
1 ,, 5½	10 24	10 7	22 7	33 0	182 0	1 ,, 16	3 34	30 10	65 8	96 0	1536 0
1 ,, 6	9 32	11 6½	24 8	36 0	217 0	1 ,, 17	3 22	32 9	69 9	102 0	1734 0
1 ,, 6½	8 48	12 6	26 8½	39 0	254 0	1 ,, 18	3 10	34 8	73 11	108 0	1944 0
1 ,, 7	8 10	13 5½	28 9	42 0	294 0						

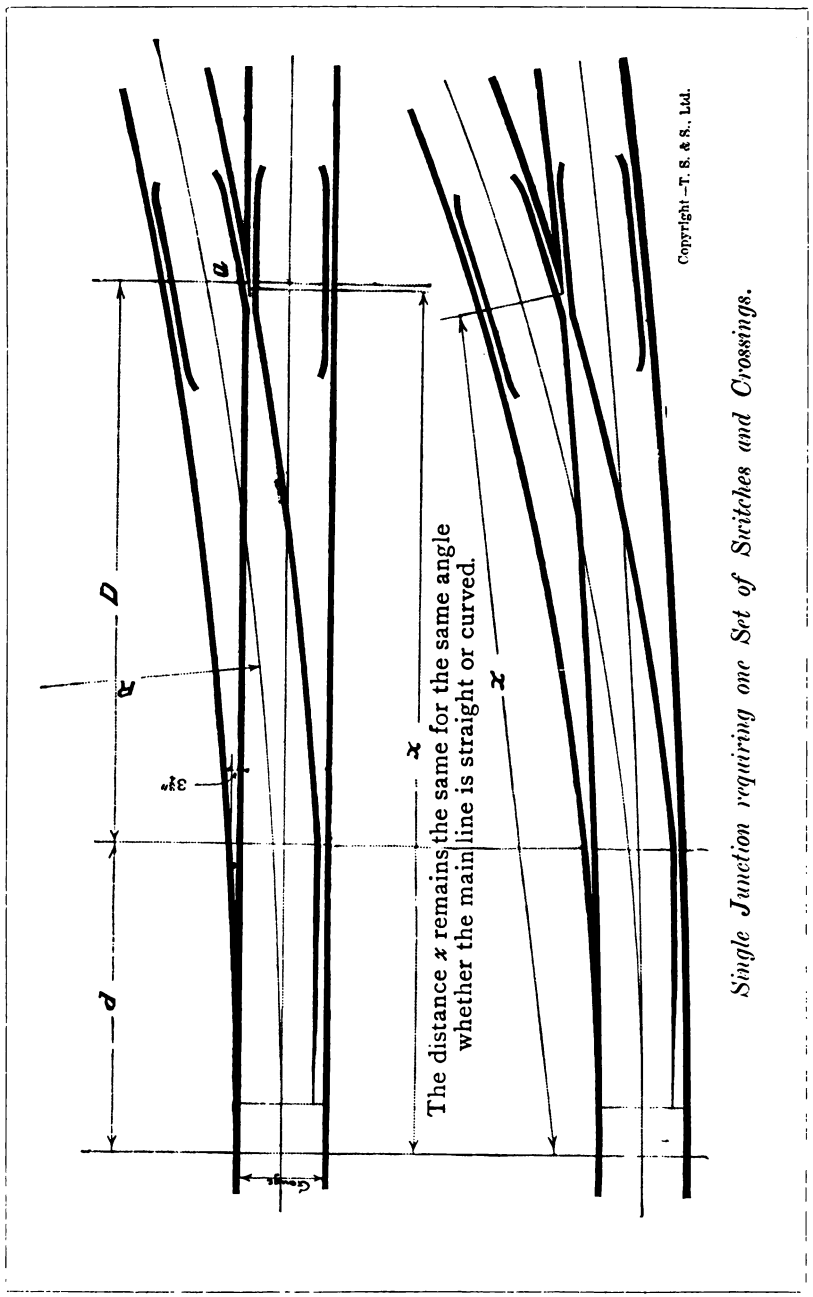


3 ft. Gauge. Diagram No. 2.

THREE THROWS.

3 ft. Gauge. Table No. 2.

Angle of Crossings. a a1	Angle of Crossing. b	Spring of Curve to Heel of Switches. d	D Heel of Switches to Nose of Crossings. a a1	K Heel of Switches to Nose of Crossing. b	Radius of Inside Curve. r	Radius of Curve. R	Angle of Crossings. a a1	Angle of Crossing. b	Spring of Curve to Heel of Switches. d	D Heel of Switches to Nose of Crossings. a a1	K Heel of Switches to Nose of Crossing. b	Radius of Inside Curve. r	Radius of Curve. R
1 in 1¾	1 in 1'21	Ft. Ins. 3 4½	Ft. Ins. 7 2¼	Ft. Ins. 4 3	Ft. Ins. 9 3	Ft. Ins. 18 3	1 in 7½	1 in 5'29	Ft. Ins. 14 5½	Ft. Ins. 30 9½	Ft. Ins. 17 7	Ft. Ins. 169 0	Ft. ins. 338 0
1 „ 2	1 „ 1'39	3 10	8 2¾	4 9¾	12 0	24 0	1 „ 8	1 „ 5'65	15 5	32 10	18 9	192 0	384 0
1 „ 2¼	1 „ 1'57	4 4	9 3	5 4¾	15 3	30 3	1 „ 8½	1 „ 6'00	16 4	34 11	19 11	217 0	434 0
1 „ 2½	1 „ 1'75	4 9¾	10 3¼	5 5½	18 9	37 6	1 „ 9	1 „ 6'36	17 4	36 11	21 1	243 0	486 0
1 „ 2¾	1 „ 1'93	5 3½	11 3½	6 6½	22 9	45 6	1 „ 9½	1 „ 6'71	18 4	39 0	22 3	271 0	542 0
1 „ 3	1 „ 2'10	5 9¼	12 4	7 7½	27 0	54 0	1 „ 10	1 „ 7'06	19 3	41 1	23 5	300 0	600 0
1 „ 3¼	1 „ 2'28	6 3	13 4¼	7 8¼	32 0	63 6	1 „ 10½	1 „ 7'42	20 3	43 1	24 7	331 0	662 0
1 „ 3½	1 „ 2'46	6 9	14 4½	8 3¾	36 9	73 6	1 „ 11	1 „ 7'77	21 2	45 2	25 9	363 0	726 0
1 „ 3¾	1 „ 2'64	7 2½	15 4¾	8 10	42 6	84 6	1 „ 11½	1 „ 8'12	22 2	47 2	26 11	397 0	794 0
1 „ 4	1 „ 2'82	7 8¼	16 5¼	9 5	48 0	96 0	1 „ 12	1 „ 8'48	23 1	49 4	28 1	432 0	864 0
1 „ 4¼	1 „ 3'00	8 2	17 6	10 0	54 6	109 0	1 „ 12½	1 „ 8'84	24 1	51 4	29 3	469 0	938 0
1 „ 4½	1 „ 3'17	8 8	18 6	10 7	61 0	121 6	1 „ 13	1 „ 9'19	25 1	53 4	30 5	507 0	1014 0
1 „ 4¾	1 „ 3'34	9 1½	19 6	11 2	68 0	136 0	1 „ 14	1 „ 9'89	27 0	57 5	32 9	588 0	1176 0
1 „ 5	1 „ 3'52	9 7½	20 6½	11 9	75 0	150 0	1 „ 15	1 „ 10'60	28 11	61 7	35 1	675 0	1350 0
1 „ 5½	1 „ 3'88	10 7	22 7	12 11	91 0	182 0	1 „ 16	1 „ 11'31	30 10	65 8	37 5	768 0	1536 0
1 „ 6	1 „ 4'23	11 6½	24 8	14 1	108 0	217 0	1 „ 17	1 „ 12'02	32 9	69 9	39 9	867 0	1734 0
1 „ 6½	1 „ 4'58	12 6	26 8½	15 3	127 0	254 0	1 „ 18	1 „ 12'72	34 8	73 11	42 1	972 0	1944 0
1 „ 7	1 „ 4'94	13 5½	28 9	16 5	147 0	294 0							



Single Junction requiring one Set of Switches and Crossings.

3 ft. 3⅜ in. (Metre) Gauge. Diagram No. 1.

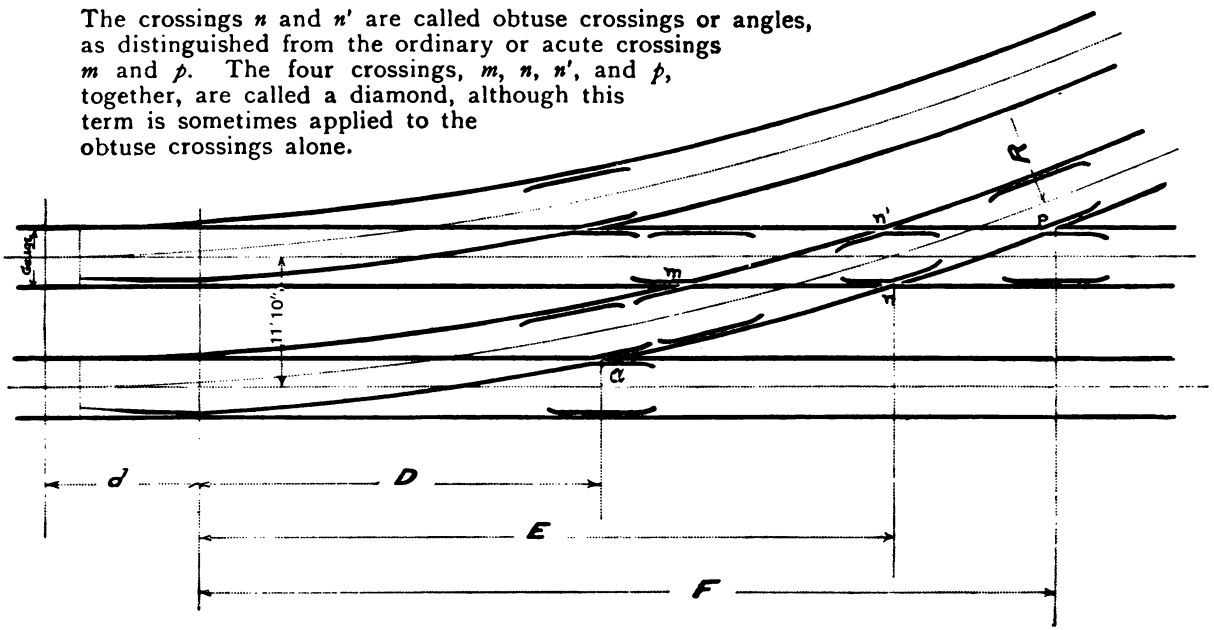
SINGLE JUNCTIONS.

3 ft. 3⅜ in. (Metre) Gauge. Table No. 1.

Angle of Crossing A In Units.	Angle of Crossing A In Degrees.	Spring of Curve to d Heel of Switches.		Heel of Switches D to Nose of Crossing A.		Spring of Curve to x Intersection of Gauge Lines.		Radius of Curve R.		Angle of Crossing A In Units.	Angle of Crossing A In Degrees.	Spring of Curve to d Heel of Switches.		Heel of Switches D to Nose of Crossing A.		Spring of Curve to x Intersection of Gauge Lines.		Radius of Curve R.	
		Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.			Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 1¾	31 52	3	6	8	0½	11	5¾	20	0	1 in 7½	7 38	15	1½	34	5	49	2½	369	0
1 ,, 2	28 4	4	0¼	9	2¼	13	1½	26	3	1 ,, 8	7 10	16	1½	36	8½	52	6	420	0
1 ,, 2¼	25 4	4	6¼	10	4	14	9	33	6	1 ,, 8½	6 44	17	1½	39	0	55	9	474	0
1 ,, 2½	22 38	5	0¼	11	5¾	16	4¾	41	0	1 ,, 9	6 22	18	1½	41	3	59	0	532	0
1 ,, 2¾	20 36	5	6½	12	7½	18	0½	50	0	1 ,, 9½	6 2	19	2	43	7	62	4	592	0
1 ,, 3	18 54	6	0½	13	8¼	19	8¼	59	0	1 ,, 10	5 44	20	2	45	10½	65	7	656	0
1 ,, 3¼	17 26	6	6½	14	11	21	4	69	6	1 ,, 10½	5 26	21	2	48	2	68	11	724	0
1 ,, 3½	16 16	7	0½	16	0¾	22	11½	80	6	1 ,, 11	5 12	22	2	50	5	72	2	794	0
1 ,, 3¾	15 12	7	6½	17	2½	24	7¼	92	6	1 ,, 11½	4 58	23	2	52	9	75	5	868	0
1 ,, 4	14 14	8	0½	18	4¼	26	3	105	0	1 ,, 12	4 46	24	2	55	1	78	9	945	0
1 ,, 4¼	13 26	8	6½	19	6	27	10½	119	0	1 ,, 12½	4 36	25	2	57	4	82	0	1025	0
1 ,, 4½	12 40	9	1	20	7½	29	6	133	0	1 ,, 13	4 24	26	2	59	8	85	3	1109	0
1 ,, 4¾	12 2	9	7	21	9½	31	2	148	0	1 ,, 14	4 6	28	3	64	2	91	10	1286	0
1 ,, 5	11 26	10	1	22	11½	32	10	164	0	1 ,, 15	3 50	30	3	68	10	98	5	1476	0
1 ,, 5½	10 24	11	1	25	3	36	1	199	0	1 ,, 16	3 34	32	3	73	4	104	11	1680	0
1 ,, 6	9 32	12	1	27	6½	39	4½	237	0	1 ,, 17	3 22	34	3	77	11	111	6	1896	0
1 ,, 6½	8 48	13	1	29	10	42	8	278	0	1 ,, 18	3 10	36	3	82	7	118	1	2126	0
1 ,, 7	8 10	14	1	32	1½	45	11	322	0										

Double Junction, requiring two Sets of Switches and Crossings, and one Diamond.

The crossings *n* and *n'* are called obtuse crossings or angles, as distinguished from the ordinary or acute crossings *m* and *p*. The four crossings, *m*, *n*, *n'*, and *p*, together, are called a diamond, although this term is sometimes applied to the obtuse crossings alone.



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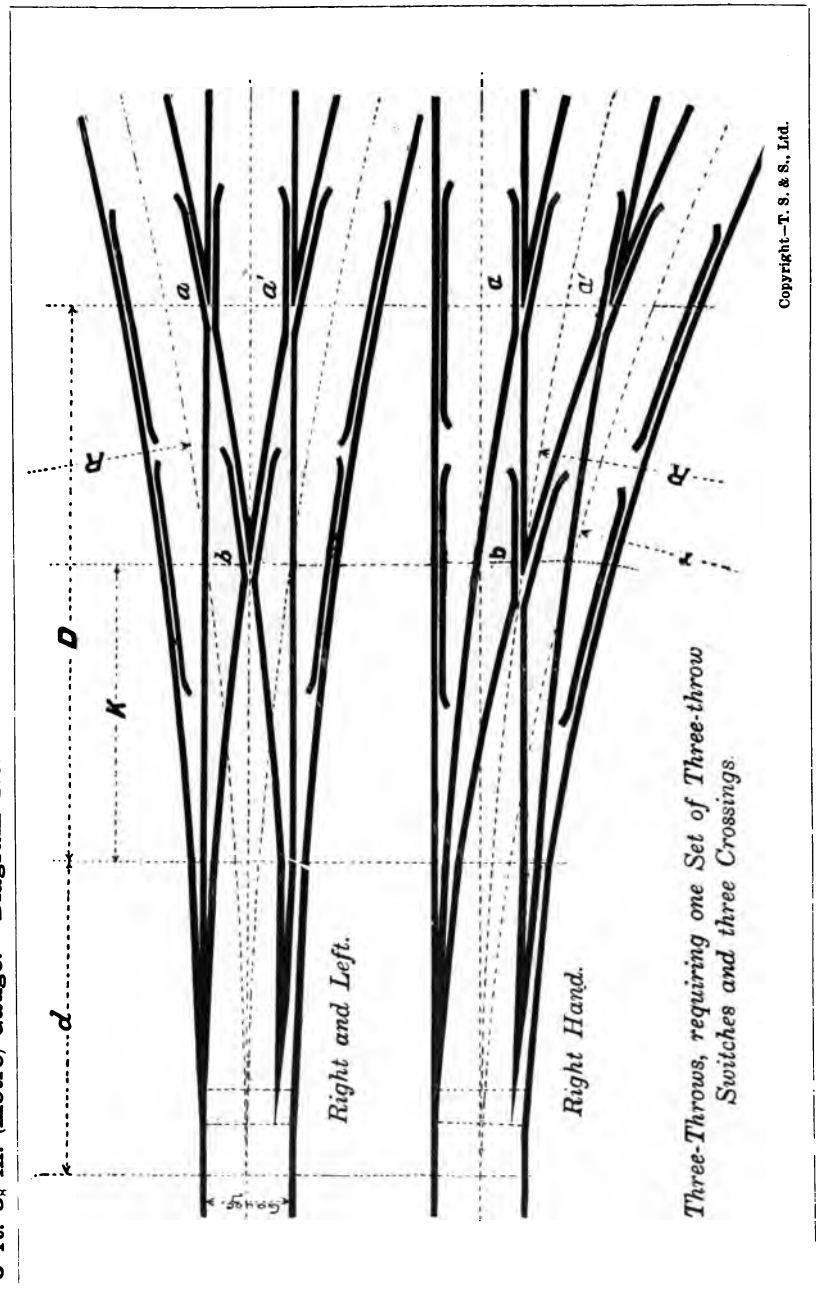
3 ft. 3½ in. (Metre) Gauge. Diagram No. 2.

DOUBLE JUNCTIONS.

3 ft. 3⅜ in. (Metre) Gauge. Table No. 2.

Angle of Crossing. a		Angle of Crossing. m		Angle of Crossing. n		Angle of Crossing. n'		Angle of Crossing. p		d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossing.		E Heel of Switches to Knees of Crossing.		F Heel of Switches to Nose of Crossing. P		R Radius of Curve,	
1 in	12¾	1 in	·91	1 in	·82	1 in	·73	1 in	·68	3	6	8	0½	15	10	17	2½	20	0
1 ,,	2	1 ,,	1·09	1 ,,	·96	1 ,,	·89	1 ,,	·82	4	0½	9	2¼	18	9½	20	9½	26	3
1 ,,	2¼	1 ,,	1·26	1 ,,	1·11	1 ,,	1·04	1 ,,	·95	4	6½	10	4	21	7¾	24	5¾	33	6
1 ,,	2½	1 ,,	1·43	1 ,,	1·25	1 ,,	1·19	1 ,,	1·08	5	0½	11	5½	24	5¾	27	6¾	41	0
1 ,,	2¾	1 ,,	1·60	1 ,,	1·38	1 ,,	1·33	1 ,,	1·20	5	6½	12	7½	27	2½	30	10	50	0
1 ,,	3	1 ,,	1·76	1 ,,	1·52	1 ,,	1·47	1 ,,	1·33	6	0½	13	8¾	29	11½	34	0¾	59	0
1 ,,	3¼	1 ,,	1·92	1 ,,	1·66	1 ,,	1·61	1 ,,	1·45	6	6½	14	11	32	8	37	3	69	6
1 ,,	3½	1 ,,	2·09	1 ,,	1·79	1 ,,	1·75	1 ,,	1·57	7	0½	16	0¾	35	4½	40	5¼	80	6
1 ,,	3¾	1 ,,	2·25	1 ,,	1·93	1 ,,	1·89	1 ,,	1·69	7	6½	17	2½	38	0½	43	7	92	6
1 ,,	4	1 ,,	2·41	1 ,,	2·06	1 ,,	2·03	1 ,,	1·81	8	0½	18	4¼	40	8¾	46	8¾	105	0
1 ,,	4¼	1 ,,	2·57	1 ,,	2·20	1 ,,	2·16	1 ,,	1·93	8	6½	19	6	43	5	49	10	119	0
1 ,,	4½	1 ,,	2·72	1 ,,	2·33	1 ,,	2·30	1 ,,	2·05	9	1	20	7½	46	1	52	11½	133	0
1 ,,	4¾	1 ,,	2·89	1 ,,	2·46	1 ,,	2·44	1 ,,	2·17	9	7	21	9½	48	9½	56	0½	148	0
1 ,,	5	1 ,,	3·04	1 ,,	2·60	1 ,,	2·57	1 ,,	2·29	10	1	22	11½	51	4½	59	1½	164	0
1 ,,	5½	1 ,,	3·36	1 ,,	2·86	1 ,,	2·84	1 ,,	2·52	11	1	25	3	56	8½	65	3½	199	0
1 ,,	6	1 ,,	3·67	1 ,,	3·13	1 ,,	3·11	1 ,,	2·76	12	1	27	6½	62	0	71	5	237	1
1 ,,	6½	1 ,,	3·98	1 ,,	3·40	1 ,,	3·38	1 ,,	3·00	13	1	29	10	67	3	77	7	278	0
1 ,,	7	1 ,,	4·30	1 ,,	3·66	1 ,,	3·65	1 ,,	3·23	14	1	32	1½	72	6	83	8	322	0

Angle of Crossing. a		Angle of Crossing. m		Angle of Crossing. n		Angle of Crossing. n'		Angle of Crossing. p		d Spring of Curve to Heel of Switches.		D Heel of Switches to Nose of Crossing.		E Heel of Switches to Knees of Crossing.		F Heel of Switches to Nose of Crossing. P		R Radius of Curve,	
1 in	7½	1 in	4·61	1 in	3·47	1 in	4·07	1 in	15	1½	34	5	77	9	89	9	369	0
1 ,,	8	1 ,,	4·92	1 ,,	3·70	1 ,,	4·34	1 ,,	16	1½	36	8½	83	0½	95	10½	420	0
1 ,,	8½	1 ,,	5·23	1 ,,	3·93	1 ,,	4·61	1 ,,	17	1½	39	0	88	4	102	0	474	0
1 ,,	9	1 ,,	5·54	1 ,,	4·17	1 ,,	4·89	1 ,,	18	1½	41	3	93	7	108	1	532	0
1 ,,	9½	1 ,,	5·85	1 ,,	4·40	1 ,,	5·16	1 ,,	19	2	43	7	98	9	114	2	592	0
1 ,,	10	1 ,,	6·17	1 ,,	4·64	1 ,,	5·44	1 ,,	20	2	45	10½	104	0	120	2	656	0
1 ,,	10½	1 ,,	6·48	1 ,,	4·87	1 ,,	5·71	1 ,,	21	2	48	2	109	3	126	3	724	0
1 ,,	11	1 ,,	6·79	1 ,,	5·11	1 ,,	5·98	1 ,,	22	2	50	5	114	6	132	4	794	0
1 ,,	11½	1 ,,	7·10	1 ,,	5·34	1 ,,	6·25	1 ,,	23	2	52	9	119	9	138	5	868	0
1 ,,	12	1 ,,	7·41	1 ,,	5·57	1 ,,	6·53	1 ,,	24	2	55	1	125	0	144	6	945	0
1 ,,	12½	1 ,,	7·72	1 ,,	5·81	1 ,,	6·80	1 ,,	25	2	57	4	130	3	150	6	1025	0
1 ,,	13	1 ,,	8·03	1 ,,	6·04	1 ,,	7·07	1 ,,	26	2	59	8	135	6	156	7	1109	0
1 ,,	14	1 ,,	8·66	1 ,,	6·51	1 ,,	7·62	1 ,,	28	3	64	2	145	11	168	9	1286	0
1 ,,	15	1 ,,	9·27	1 ,,	6·97	1 ,,	8·17	1 ,,	30	3	68	10	156	5	180	10	1476	0
1 ,,	16	1 ,,	9·89	1 ,,	7·44	1 ,,	8·71	1 ,,	32	3	73	4	166	10	193	0	1680	0
1 ,,	17	1 ,,	10·51	1 ,,	7·91	1 ,,	9·26	1 ,,	34	3	77	11	177	4	205	1	1896	0
1 ,,	18	1 ,,	11·13	1 ,,	8·37	1 ,,	9·80	1 ,,	36	3	82	7	187	9	217	2	2126	0

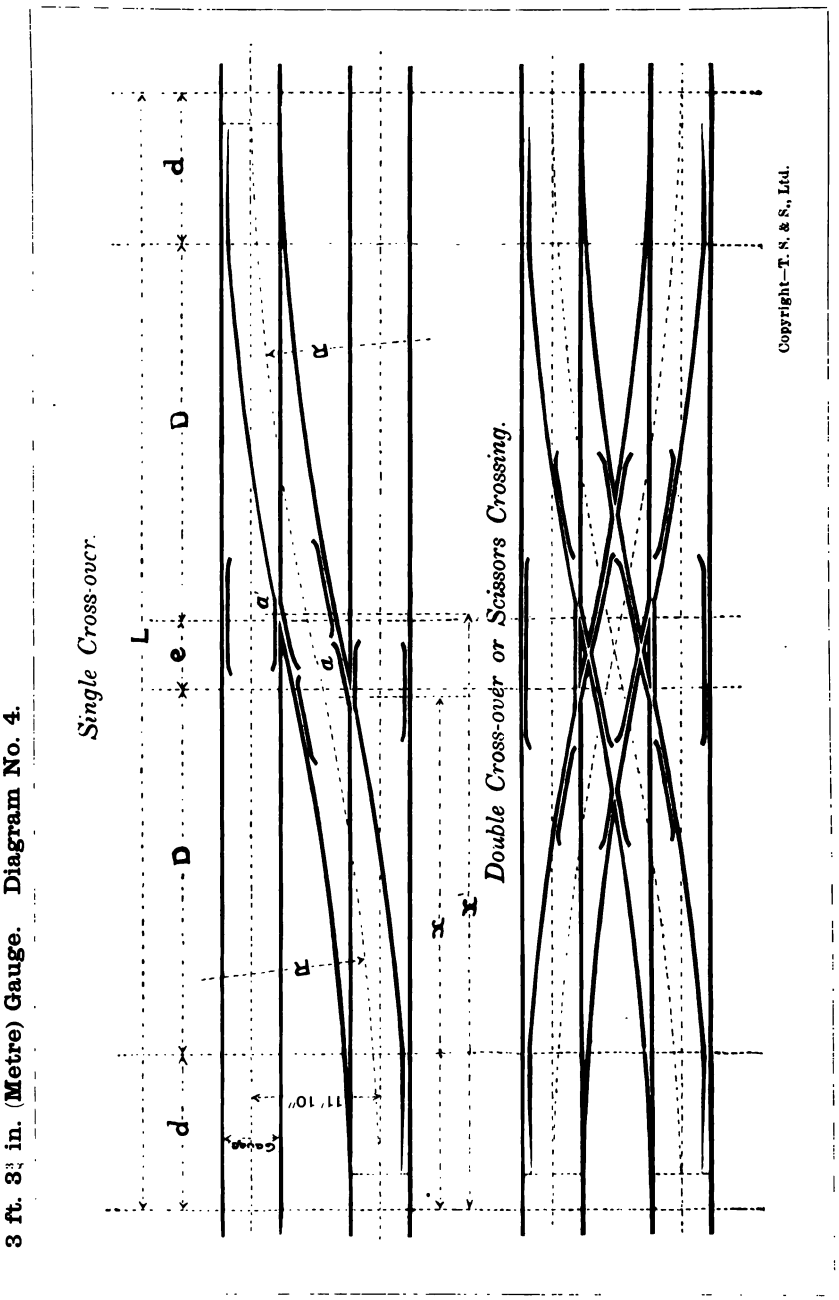


3 ft. 3⅜ in. (Metre) Gauge. Diagram No. 3.

THREE THROWS.

3 ft. 3¾ in. (Metre) Gauge. Table No. 3.

Angle of Crossings. a a¹	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a¹	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.	Angle of Crossings. a a¹	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a¹	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.
1 in 1¾	1 in 1'21	Ft. Ins. 3 6	Ft. Ins. 8 0½	Ft. Ins. 4 9¾	Ft. Ins. 10 0	Ft. 20	Ins. 0	1 in 7½	1 in 5'29	Ft. Ins. 15 15½	Ft. Ins. 34 5	Ft. Ins. 19 11	Ft. Ins. 185 0	Ft. Ins. 369 0
1 ,, 2	1 ,, 1'39	4 0¼	9 2¼	5 5¼	13 3	26	3	1 ,, 8	1 ,, 5'65	16 16½	36 8½	21 3	210 0	420 0
1 ,, 2¼	1 ,, 1'57	4 0¼	10 4	6 1¼	16 9	33	6	1 ,, 8½	1 ,, 6'00	17 17½	39 0	22 7	237 0	474 0
1 ,, 2½	1 ,, 1'75	5 0¼	11 5¾	6 9	20 6	41	0	1 ,, 9	1 ,, 6'36	18 18½	41 3	23 11	266 0	532 0
1 ,, 2¾	1 ,, 1'93	5 0½	12 7½	7 5	24 9	50	0	1 ,, 9½	1 ,, 6'71	19 2	43 7	25 3	296 0	592 0
1 ,, 3	1 ,, 2'10	6 0½	13 8¼	8 0¾	29 6	59	0	1 ,, 10	1 ,, 7'06	20 2	45 10½	26 7	328 0	656 0
1 ,, 3¼	1 ,, 2'28	6 0½	14 11	8 8½	35 0	69	6	1 ,, 10½	1 ,, 7'42	21 2	48 2	27 10	362 0	724 0
1 ,, 3½	1 ,, 2'46	7 0¼	16 0¾	9 4¼	40 6	80	6	1 ,, 11	1 ,, 7'77	22 2	50 5	29 2	397 0	794 0
1 ,, 3¾	1 ,, 2'64	7 0½	17 2½	10 0¼	46 6	92	6	1 ,, 11½	1 ,, 8'12	23 2	52 9	30 6	434 0	868 0
1 ,, 4	1 ,, 2'82	8 0½	18 4¼	10 8¼	52 6	105	0	1 ,, 12	1 ,, 8'48	24 2	55 1	31 10	473 0	945 0
1 ,, 4¼	1 ,, 3'00	8 0½	19 6	11 4	59 6	119	0	1 ,, 12½	1 ,, 8'84	25 2	57 4	33 2	513 0	1025 0
1 ,, 4½	1 ,, 3'17	9 1	20 7½	11 11½	66 6	133	0	1 ,, 13	1 ,, 9'19	26 2	59 8	34 6	555 0	1109 0
1 ,, 4¾	1 ,, 3'34	9 1	21 9½	12 8	74 0	148	0	1 ,, 14	1 ,, 9'89	28 3	64 2	37 2	643 0	1286 0
1 ,, 5	1 ,, 3'52	10 1	22 11½	13 3½	82 0	164	0	1 ,, 15	1 ,, 10'60	30 3	68 10	39 9	738 0	1476 0
1 ,, 5½	1 ,, 3'88	11 1	25 3	14 8	99 6	199	0	1 ,, 16	1 ,, 11'31	32 3	73 4	42 5	840 0	1680 0
1 ,, 6	1 ,, 4'23	12 1	27 6½	15 11½	118 0	237	0	1 ,, 17	1 ,, 12'02	34 3	77 11	45 1	948 0	1896 0
1 ,, 6½	1 ,, 4'58	13 1	29 10	17 3½	139 0	278	0	1 ,, 18	1 ,, 12'72	36 3	82 7	47 9	1063 0	2126 0
1 ,, 7	1 ,, 4'94	14 1	32 1½	18 7½	161 0	322	0							



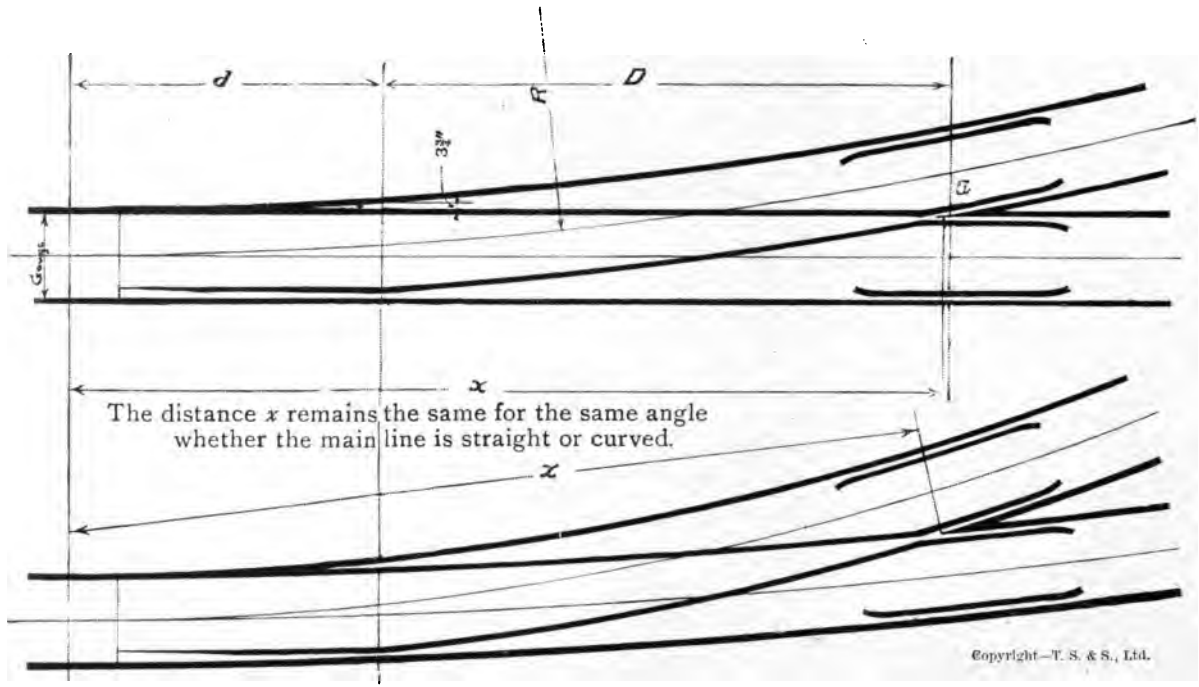
3 ft. 3¾ in. (Metre) Gauge. Diagram No. 4.

SINGLE AND DOUBLE CROSS-OVERS.

3 ft. 3⅜ in. (Metre) Gauge. Table No. 4.

Angle of Crossings. a a¹	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Cro-sings. a a¹	e Nose to Nose of Crossings. a a¹	x Spring of Curve to intersection of Gauge Lines at Crossing a.	x¹ Spring of Curve to intersection of Gauge Lines at Crossing a¹	L Spring of Curve to Spring of Curve.	R Radius of Curve.
	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1¾	3 6	8 0½	5 4¼	11 5¾	17 0	28 5½	20 0
1 ,, 2	4 0¼	9 2¼	6 9¼	13 1⅝	20 1	33 2	26 3
1 ,, 2¼	4 6¼	10 4	8 1½	14 9	23 1	37 10	33 6
1 ,, 2½	5 0¼	11 5⅜	9 5	16 4⅜	26 0	42 5	41 0
1 ,, 2¾	5 6¼	12 7⅜	10 8	18 0⅜	28 11	47 0	50 0
1 ,, 3	6 0½	13 8¾	11 11	19 8¾	31 10	51 6½	59 0
1 ,, 3¼	6 6½	14 11	13 1¼	21 4	34 8½	56 0	69 6
1 ,, 3½	7 0½	16 0¾	14 3⅜	22 11⅜	37 6¾	60 6	80 6
1 ,, 3¾	7 6½	17 2½	15 6	24 7¼	40 5	65 0	92 6
1 ,, 4	8 0½	18 4¼	16 8	26 3	43 3	69 6	105 0
1 ,, 4¼	8 6½	19 6	17 10	27 10½	46 1	74 0	119 0
1 ,, 4½	9 1	20 7½	19 0	29 6	48 11	78 5	133 0
1 ,, 4¾	9 7	21 9½	20 1½	31 2	51 8	82 10	148 0
1 ,, 5	10 1	22 11⅝	21 3⅝	32 10	54 6	87 4	164 0
1 ,, 5½	11 1	25 3	23 7	36 1	60 1	96 2	199 0
1 ,, 6	12 1	27 6½	25 9½	39 4½	65 8	105 0	237 0
1 ,, 6½	13 1	29 10	28 1	42 8	71 3	113 11	278 0
1 ,, 7	14 1	32 1⅝	30 4	45 11	76 10	122 9	322 0

Angle of Crossings. a a¹	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a¹	e Nose to Nose of Crossings. a a¹	x Spring of Curve to intersection of Gauge Lines at Crossing a.	x¹ Spring of Curve to intersection of Gauge Lines at Crossing a¹	L Spring of Curve to Spring of Curve.	R Radius of Curve.
	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 7½	15 1½	34 5	32 7	49 2⅜	82 5	131 7	369 0
1 ,, 8	16 1⅝	36 8½	34 10	52 6	88 0	140 6	420 0
1 ,, 8½	17 1½	39 0	37 1	55 9	93 7	149 4	474 0
1 ,, 9	18 1⅝	41 3	39 4	59 0	99 1	158 2	532 0
1 ,, 9½	19 2	43 7	41 7	62 4	104 8	167 0	592 0
1 ,, 10	20 2	45 10½	43 9	65 7	110 2	175 10	656 0
1 ,, 10½	21 2	48 2	46 0	68 11	115 9	184 8	724 0
1 ,, 11	22 2	50 5	48 3	72 2	121 4	193 6	794 0
1 ,, 11½	23 2	52 9	50 6	75 5	126 10	202 4	868 0
1 ,, 12	24 2	55 1	52 8	78 9	132 5	211 2	945 0
1 ,, 12½	25 2	57 4	54 11	82 0	137 11	220 0	1025 0
1 ,, 13	26 2	59 8	57 1	85 3	143 6	228 9	1109 0
1 ,, 14	28 3	64 2	61 7	91 10	154 8	246 6	1286 0
1 ,, 15	30 3	68 10	66 0	98 5	165 8	264 0	1476 0
1 ,, 16	32 3	73 4	70 5	104 11	176 9	281 8	1680 0
1 ,, 17	34 3	77 11	74 10	111 6	187 10	299 4	1896 0
1 ,, 18	36 3	82 7	79 3	118 1	198 10	316 11	2126 0



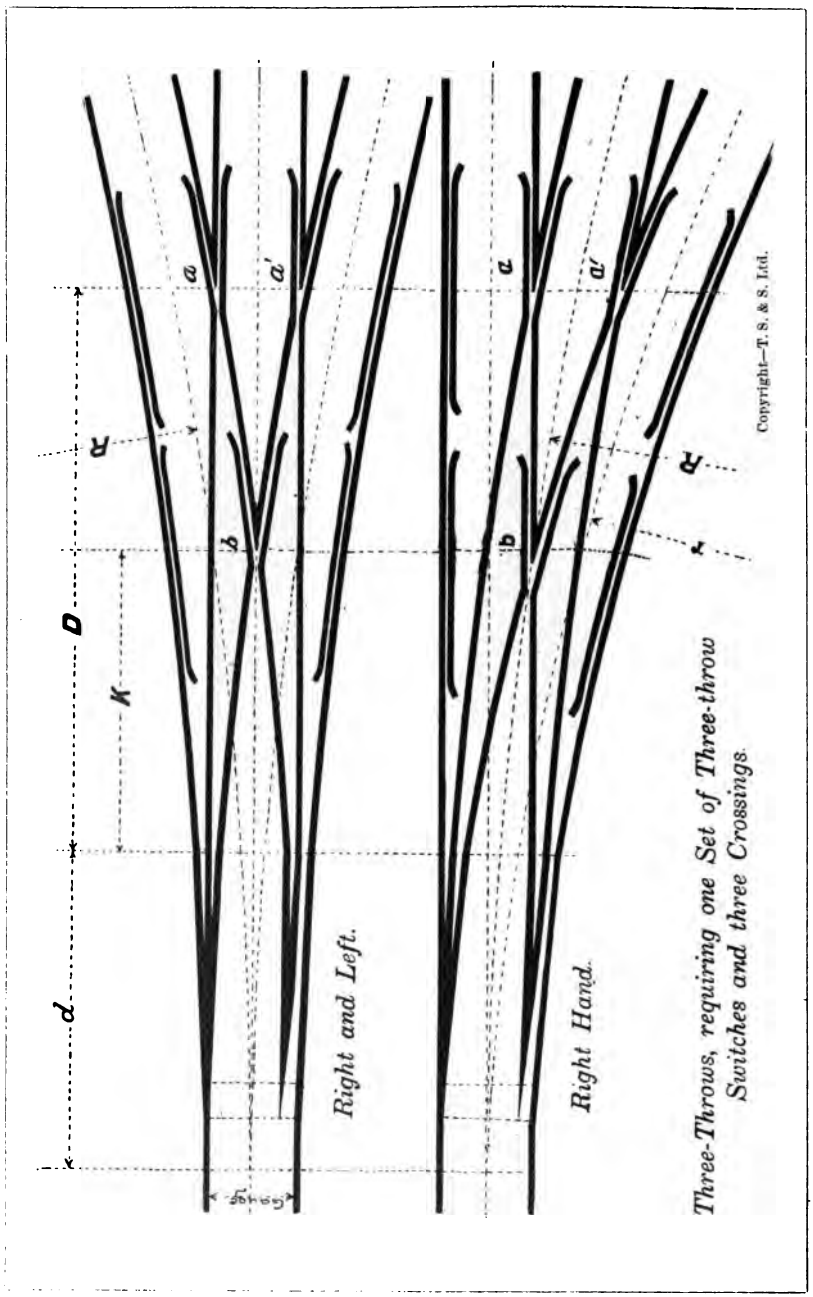
Single Junction requiring one Set of Switches and Crossings.

3 ft. 6 in. Gauge. Diagram No. 1.

SINGLE JUNCTIONS.

3 ft. 6 in. Gauge. Table No. 1.

Angle of Crossing. a In Units.	Angle of Crossing. a In Degrees.	Spring of Curve to Heel of Switches. d	Heel of Switches to Nose of Crossing. D a	Spring of Curve to intersection of Gauge Lines. x	Radius of curve. R	Angle of Crossing. a In Units.	Angle of Crossing. a In Degrees.	Spring of Curve to Heel of Switches. d	Heel of Switches to Nose of Crossing. D a	Spring of Curve to intersection of Gauge Lines. x	Radius of Curve. R
	Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	1 in 7½	Deg. Min. 7 38	Ft. Ins. 15 7½	Ft. Ins. 37 2½	Ft. Ins. 52 6	Ft. Ins. 394 0
1 in 1¾	31 52	3 7½	8 8½	12 3	21 6	1 ,, 8½	7 10	16 8	39 8	56 0	448 0
1 ,, 2	28 4	4 1¾	9 11¼	14 0	28 0	1 ,, 8½	6 44	17 8	42 2	59 6	506 0
1 ,, 2¼	25 4	4 8	11 2¼	15 9	35 6	1 ,, 9	6 22	18 9	44 8	63 0	567 0
1 ,, 2½	22 38	5 2¼	12 5	17 6	44 0	1 ,, 9½	6 2	19 9	47 2	66 6	632 0
1 ,, 2¾	20 36	5 8½	13 7½	19 3	53 0	1 ,, 10	5 44	20 10	49 7	70 0	700 0
1 ,, 3	18 54	6 2¾	14 10¾	21 0	63 0	1 ,, 10½	5 26	21 10	52 1	73 6	772 0
1 ,, 3¼	17 26	6 9	16 1½	22 9	74 0	1 ,, 11	5 12	22 11	54 7	77 0	847 0
1 ,, 3½	16 16	7 3¼	17 4½	24 6	86 0	1 ,, 11½	5 2	23 11	57 1	80 6	926 0
1 ,, 3¾	15 12	7 9½	18 7½	26 3	98 6	1 ,, 12	4 58	25 0	59 6	84 0	1008 0
1 ,, 4	14 14	8 3¾	19 10¼	28 0	112 0	1 ,, 12½	4 46	26 0	62 0	87 6	1094 0
1 ,, 4¼	13 26	8 10	21 1	29 9	127 0	1 ,, 13	4 36	27 1	64 6	91 0	1183 0
1 ,, 4½	12 40	9 4½	22 4	31 6	142 0	1 ,, 14	4 24	29 2	69 5	98 0	1372 0
1 ,, 4¾	12 2	9 10½	23 7	33 3	158 0	1 ,, 15	4 6	31 3	74 5	105 0	1575 0
1 ,, 5	11 26	10 5	24 9½	35 0	175 0	1 ,, 16	3 50	33 4	79 4	112 0	1792 0
1 ,, 5½	10 24	11 5½	27 3½	38 6	212 0	1 ,, 17	3 34	35 5	84 4	119 0	2023 0
1 ,, 6	9 32	12 6	29 9	42 0	252 0	1 ,, 18	3 22	37 6	89 3	126 0	2268 0
1 ,, 6½	8 48	13 6½	32 3	45 6	296 0						
1 ,, 7	8 10	14 7	34 8½	49 0	343 0						



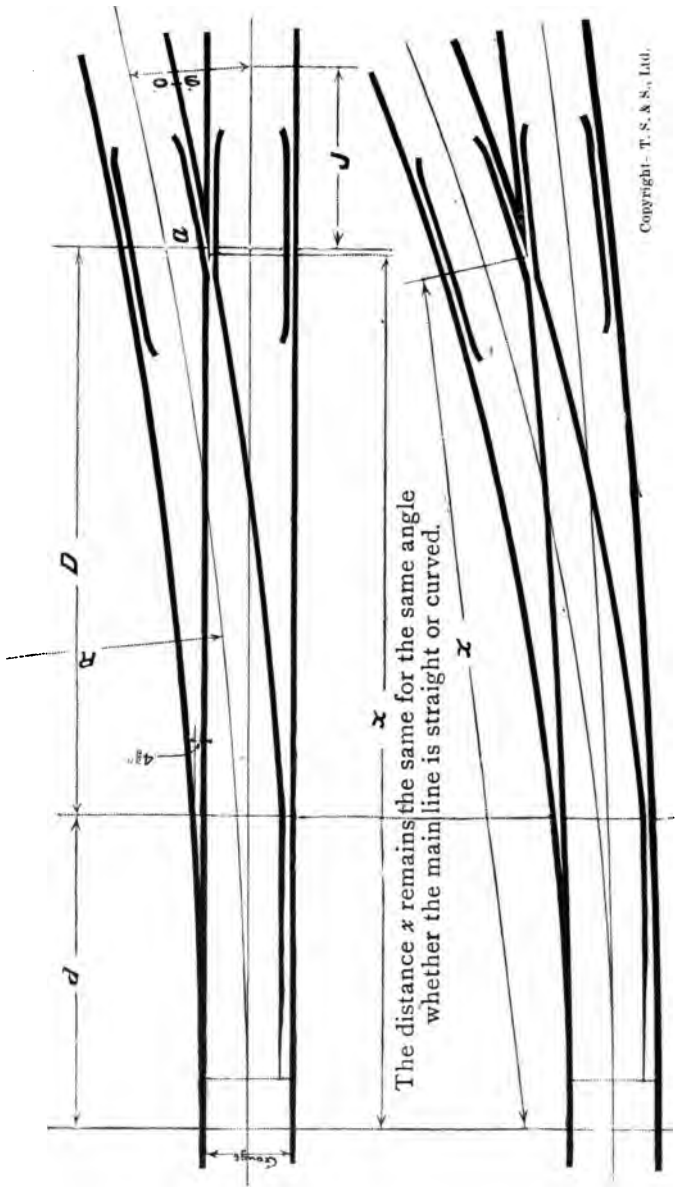
3 ft. 6 in. Gauge. Diagram No. 2.

THREE THROWS.

3 ft. 6 in. Gauge. Table No. 2.

Angle of Crossings. a a¹	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a¹	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.	Angle of Crossings. a a¹	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a¹	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.
1 in 1¾	1 in 1·21	Ft. Ins. 3 7 1/2	Ft. Ins. 8 8 1/2	Ft. Ins. 5 3	Ft. Ins. 10 9	Ft. Ins. 21 6	1 in 7 1/2	1 in 5·29	Ft. Ins. 15 7 1/2	Ft. Ins. 37 2 1/2	Ft. Ins. 21 9	Ft. Ins. 197 0	Ft. Ins. 394 0
1 ,, 2	1 ,, 1·39	4 11 3/4	9 11 1/4	5 11 1/2	14 0	28 0	1 ,, 8	1 ,, 5·65	16 8	39 8	23 2 1/2	224 0	448 0
1 ,, 2 1/4	1 ,, 1·57	4 8	11 2 1/4	6 8	17 9	35 6	1 ,, 8 1/2	1 ,, 6·00	17 8	42 2	24 8	253 0	506 0
1 ,, 2 1/2	1 ,, 1·75	5 2 1/4	12 5	7 4 3/4	22 0	44 0	1 ,, 9	1 ,, 6·36	18 9	44 8	26 1	284 0	567 0
1 ,, 2 3/4	1 ,, 1·93	5 8 1/2	13 7 3/4	8 1	26 6	53 0	1 ,, 9 1/2	1 ,, 6·71	19 9	47 2	27 7	316 0	632 0
1 ,, 3	1 ,, 2·10	6 2 1/4	14 10 3/4	8 9 1/2	31 6	63 0	1 ,, 10	1 ,, 7·06	20 10	49 7	29 0	350 0	700 0
1 ,, 3 1/4	1 ,, 2·28	6 9	16 1 1/2	9 6	37 0	74 0	1 ,, 10 1/2	1 ,, 7·42	21 10	52 1	30 5	386 0	772 0
1 ,, 3 1/2	1 ,, 2·46	7 3 1/4	17 4 1/2	10 2 3/4	43 0	86 0	1 ,, 11	1 ,, 7·77	22 11	54 7	31 11	424 0	847 0
1 ,, 3 3/4	1 ,, 2·64	7 9 1/2	18 7 1/2	10 11 1/2	49 6	98 6	1 ,, 11 1/2	1 ,, 8·12	23 11	57 1	33 4	463 0	926 0
1 ,, 4	1 ,, 2·82	8 3 3/4	19 10 1/4	11 8	56 0	112 0	1 ,, 12	1 ,, 8·48	25 0	59 6	34 10	504 0	1008 0
1 ,, 4 1/4	1 ,, 3·00	8 10	21 1	12 4 1/2	63 6	127 0	1 ,, 12 1/2	1 ,, 8·84	26 0	62 0	36 3	547 0	1094 0
1 ,, 4 1/2	1 ,, 3·17	9 4 1/2	22 4	13 1 1/2	71 0	142 0	1 ,, 13	1 ,, 9·19	27 1	64 6	37 8	592 0	1183 0
1 ,, 4 3/4	1 ,, 3·34	9 10 1/2	23 7	13 10	79 0	158 0	1 ,, 14	1 ,, 9·89	29 2	69 5	40 7	686 0	1372 0
1 ,, 5	1 ,, 3·52	10 5	24 9 1/2	14 6 1/2	87 6	175 0	1 ,, 15	1 ,, 10·60	31 3	74 5	43 5	788 0	1575 0
1 ,, 5 1/2	1 ,, 3·88	11 5 1/2	27 3 1/2	16 0	106 0	212 0	1 ,, 16	1 ,, 11·31	33 4	79 4	46 4	896 0	1792 0
1 ,, 6	1 ,, 4·23	12 6	29 9	17 5	126 0	252 0	1 ,, 17	1 ,, 12·02	35 5	84 4	49 3	1012 0	2023 0
1 ,, 6 1/2	1 ,, 4·58	13 6 1/2	32 3	18 10 1/2	148 0	296 0	1 ,, 18	1 ,, 12·72	37 6	89 3	52 2	1134 0	2268 0
1 ,, 7	1 ,, 4·94	14 7	34 8 1/2	20 4	172 0	343 0							

4 ft. 8½ in. Gauge. Diagram No. 1.



Single Junction requiring one Set of Switches and Crossings.

SINGLE JUNCTIONS.

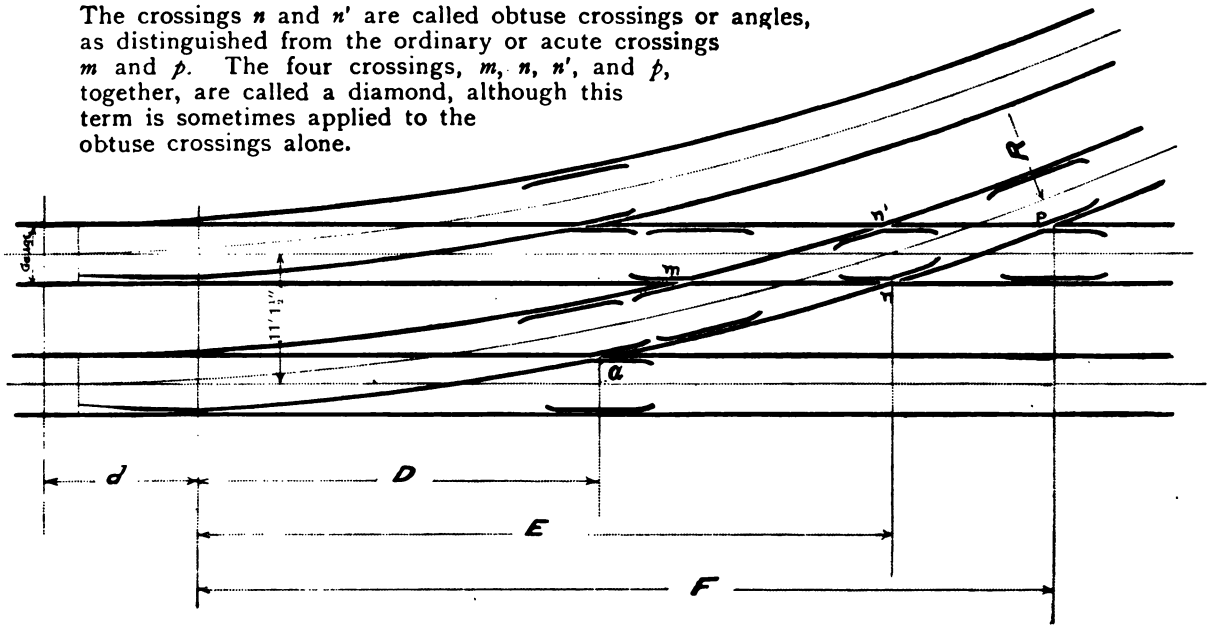
4 ft. 8½ in. Gauge. Table No. 1.

Angle of Crossing. a In Units.	Angle of Crossing. a In Degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing.	x Spring of Curve to intersection of Gauge Lines.	J Crossing Nose to point where Trucks work clear.	R Radius of Curve. In feet.	R Radius of Curve. In chains.
1 in 1¾	Deg. Min.	Ft. Ins.	Ft.	Ft. Ins.	Ft. Ins.	Ft. Ins.	
1 in 1¾	31 52	4 6¼	12	16 5¾	4 11¼	29 0	·44
1 ,, 2	28 4	5 2¼	13 9¼	18 10	6 2¾	37 6	·57
1 ,, 2¼	25 4	5 9¾	15 6	21 2¼	7 0	47 6	·72
1 ,, 2½	22 38	6 6	17 2¼	23 6¾	7 9¾	59 0	·89
1 ,, 2¾	20 36	7 1½	18 11½	25 10¾	9 0½	71 0	1·01
1 ,, 3	18 54	7 10	20 7	28 3¼	9 11	84 6	1·28
1 ,, 3¼	17 26	8 5¼	22 4¼	30 7¼	11 1¾	99 6	1·51
1 ,, 3½	16 16	9 1¼	24 0¾	32 11½	11 11¼	116 0	1·75
1 ,, 3¾	15 12	9 9	25 9½	35 4	12 8½	133 0	2·01
1 ,, 4	14 14	10 4¾	27 6	37 8	13 6	151 0	2·3
1 ,, 4¼	13 26	11 0½	29 3	40 0½	14 9	170 0	2·57
1 ,, 4½	12 40	11 8½	30 11½	42 5	16 0½	191 0	2·89
1 ,, 4¾	12 2	12 4	32 8	44 9	16 4	212 0	3·21
1 ,, 5	11 26	13 0	34 5	47 1½	17 7	235 0	3·56
1 ,, 5½	10 24	14 3½	37 10	51 10	19 2	285 0	4·31
1 ,, 6	9 32	15 7½	41 3	56 6	20 9	339 0	5·13
1 ,, 6½	8 48	16 11	44 8½	61 3	23 3½	398 0	6·03
1 ,, 7	8 10	18 2½	48 3	65 11½	24 9	461 0	6·98

Angle of Crossing. a In Units.	Angle of Crossing. a In Degrees.	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossing.	x Spring of Curve to intersection of Gauge Lines.	J Crossing Nose to point where Trucks work clear.	R Radius of Curve. In feet.	R Radius of Curve. In chains.
1 in 7½	Deg. Min.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	
1 ,, 8	7 38	19 6	51 7	70 8	26 5	529 0	8·01
1 ,, 8½	7 10	20 10	55 0	75 4½	28 0	602 0	9·12
1 ,, 9	6 44	22 1	58 6	80 1	29 6	680 0	10·30
1 ,, 9½	6 22	23 5	61 11	84 10	32 1	762 0	11·54
1 ,, 9½	6 2	24 9	65 4	89 6	33 8	849 0	12·86
1 ,, 10	5 44	26 0	68 9	94 2	35 3	941 0	14·26
1 ,, 10½	5 26	27 4	72 2	98 11	36 10	1037 0	15·71
1 ,, 11	5 12	28 7	75 8	103 8	39 4	1139 0	17·25
1 ,, 11½	4 58	29 11	79 1	108 4	40 11	1244 0	18·83
1 ,, 12	4 46	31 3	82 6	113 1	42 6	1355 0	20·53
1 ,, 12½	4 36	32 6	85 11	117 9	44 1	1470 0	22·27
1 ,, 13	4 24	33 10	89 5	122 6	45 7	1590 0	24·09
1 ,, 14	4 6	36 5	96 3	131 11	49 9	1844 0	27·94
1 ,, 15	3 50	39 0	103 2	141 4	52 10	2117 0	32·07
1 ,, 16	3 34	41 8	110 0	150 9	57 0	2409 0	36·5
1 ,, 17	3 22	44 3	116 11	160 2	60 1	2719 0	41·2
1 ,, 18	3 10	46 10	123 9	169 7	64 3	3049 0	46·2

Double Junction, requiring two Sets of Switches and Crossings, and one Diamond.

The crossings *n* and *n'* are called obtuse crossings or angles, as distinguished from the ordinary or acute crossings *m* and *p*. The four crossings, *m*, *n*, *n'*, and *p*, together, are called a diamond, although this term is sometimes applied to the obtuse crossings alone.



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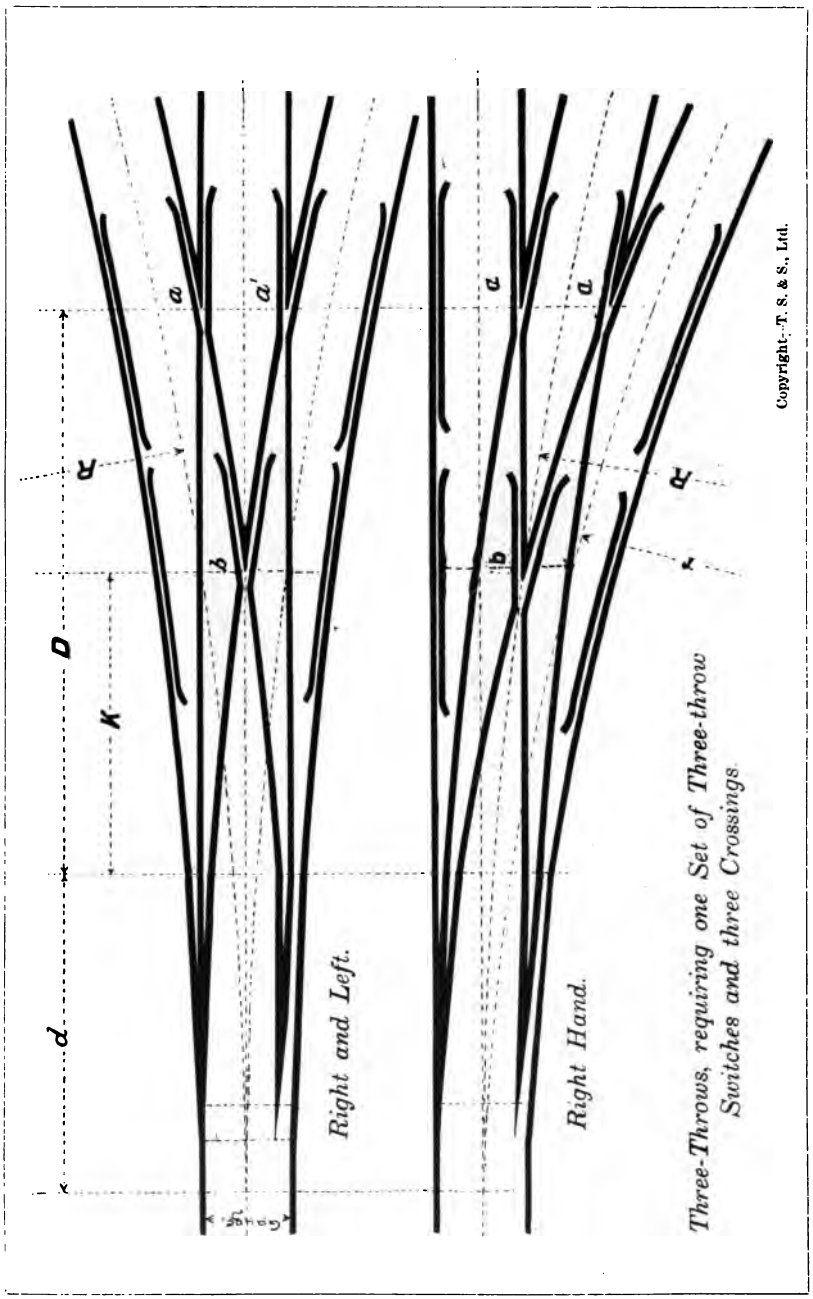
4 ft. 8½ in. Gauge. Diagram No. 2.

DOUBLE JUNCTIONS.

4 ft. 8½ in. Gauge. Table No. 2.

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossing. n	Angle of Crossing. n^1	Angle of Crossing. p	Spring of Curve to Heel of Switches. d	Heel of Switches to Nose of Crossing. D	Heel of Switches to Knees of Crossing. E	Heel of Switches to Nose of Crossing. F	Radius of Curve in feet. R	Radius of Curve in chains. R
1 in 12	1 in 1·35	1 in 1·07	1 in ·97	1 in ·86	Ft. Ins. 4 6½	Ft. Ins. 12 0¾	Ft. Ins. 19 5½	Ft. Ins. 22 7½	29 0	·44
1 ,, 2	1 ,, 1·38	1 ,, 1·25	1 ,, 1·16	1 ,, 1·01	5 2½	13 9¼	22 6½	26 8½	37 6	·57
1 ,, 2½	1 ,, 1·81	1 ,, 1·41	1 ,, 1·34	1 ,, 1·15	5 9¾	15 6	25 7½	30 8¾	47 6	·72
1 ,, 2½	1 ,, 2·04	1 ,, 1·58	1 ,, 1·51	1 ,, 1·30	6 6	17 2½	28 8	34 7½	59 0	·89
1 ,, 2½	1 ,, 2·26	1 ,, 1·75	1 ,, 1·69	1 ,, 1·44	7 1½	18 11½	31 8½	38 6	71 0	1·01
1 ,, 3	1 ,, 2·48	1 ,, 1·91	1 ,, 1·86	1 ,, 1·58	7 10	20 7	34 9	42 3½	84 6	1·28
1 ,, 3½	1 ,, 2·70	1 ,, 2·08	1 ,, 2·03	1 ,, 1·72	8 5½	22 4½	37 9½	46 1½	99 6	1·51
1 ,, 3½	1 ,, 2·92	1 ,, 2·24	1 ,, 2·20	1 ,, 1·86	9 1½	24 0½	40 9½	49 11	116 0	1·75
1 ,, 3½	1 ,, 3·14	1 ,, 2·41	1 ,, 2·36	1 ,, 2·03	9 9	25 9½	43 10	53 8½	133 0	2·01
1 ,, 4	1 ,, 3·36	1 ,, 2·57	1 ,, 2·53	1 ,, 2·14	10 4½	27 6	46 10	57 5½	151 0	2·3
1 ,, 4½	1 ,, 3·57	1 ,, 2·74	1 ,, 2·70	1 ,, 2·28	11 0½	29 3	49 10	61 2½	170 0	2·57
1 ,, 4½	1 ,, 3·79	1 ,, 2·90	1 ,, 2·86	1 ,, 2·42	11 8½	30 11½	52 10	64 11½	191 0	2·89
1 ,, 4½	1 ,, 4·01	1 ,, 3·06	1 ,, 3·03	1 ,, 2·55	12 4	32 8	55 10	68 8	212 0	3·21
1 ,, 5	1 ,, 4·23	1 ,, 3·23	1 ,, 3·20	1 ,, 2·69	13 0	34 5	58 10	72 5	235 0	3·56
1 ,, 5½	1 ,, 4·66	1 ,, 3·56	1 ,, 3·53	1 ,, 2·97	14 3½	37 10	64 9½	79 10	285 0	4·31
1 ,, 6	1 ,, 5·09	1 ,, 3·89	1 ,, 3·86	1 ,, 3·24	15 7½	41 3	70 9½	87 3	339 0	5·13
1 ,, 6½	1 ,, 5·52	1 ,, 4·21	1 ,, 4·19	1 ,, 3·52	16 11	44 8½	76 9	94 8½	398 0	6·03
1 ,, 7	1 ,, 5·95	1 ,, 4·54	1 ,, 4·52	1 ,, 3·79	18 2½	47 3	82 8½	102 1	461 0	6·98

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossings. n n¹	Angle of Crossing. p	Spring of Curve to Heel of Switches. d	Heel of Switches to Nose of Crossing. D	Heel of Switches to Knees of Crossing. E	Heel of Switches to Nose of Crossing. F	Radius of Curve in feet. R	Radius of Curve in chains. R
1 in 7½	1 in 6·38	1 in 4·86	1 in 4·07	Ft. Ins. 19 6	Ft. Ins. 51 7	Ft. Ins. 88 8	Ft. Ins. 109 6	599 0	8·01
1 ,, 8	1 ,, 6·81	1 ,, 5·19	1 ,, 4·34	20 10	55 0	94 7½	116 10½	662 0	9·12
1 ,, 8½	1 ,, 7·24	1 ,, 5·51	1 ,, 4·61	22 1	58 6	100 7	124 3	680 0	10·30
1 ,, 9	1 ,, 7·67	1 ,, 5·84	1 ,, 4·89	23 5	61 11	106 6	131 8	762 0	11·54
1 ,, 9½	1 ,, 8·10	1 ,, 6·17	1 ,, 5·16	24 9	65 4	112 6	139 0	849 0	12·86
1 ,, 10	1 ,, 8·53	1 ,, 6·49	1 ,, 5·44	26 0	68 9	118 5	146 5	941 0	14·26
1 ,, 10½	1 ,, 8·96	1 ,, 6·82	1 ,, 5·71	27 4	72 2	124 4	153 10	1037 0	15·71
1 ,, 11	1 ,, 9·39	1 ,, 7·14	1 ,, 5·98	28 7	75 8	130 4	161 2	1139 0	17·25
1 ,, 11½	1 ,, 9·82	1 ,, 7·47	1 ,, 6·25	29 11	79 1	136 3	168 6	1244 0	18·83
1 ,, 12	1 ,, 10·25	1 ,, 7·79	1 ,, 6·52	31 3	82 6	142 2	175 10	1355 0	20·53
1 ,, 12½	1 ,, 10·68	1 ,, 8·12	1 ,, 6·80	32 6	85 11	148 1	183 3	1470 0	22·27
1 ,, 13	1 ,, 11·11	1 ,, 8·45	1 ,, 7·07	33 10	89 5	154 1	190 7	1590 0	24·09
1 ,, 14	1 ,, 11·96	1 ,, 9·10	1 ,, 7·62	36 5	96 3	166 0	205 4	1844 0	27·94
1 ,, 15	1 ,, 12·82	1 ,, 9·75	1 ,, 8·17	39 0	103 2	177 10	220 0	2117 0	32·07
1 ,, 16	1 ,, 13·68	1 ,, 10·40	1 ,, 8·71	41 8	110 0	189 8	234 9	2409 0	36·5
1 ,, 17	1 ,, 14·54	1 ,, 11·05	1 ,, 9·26	44 3	116 11	201 7	249 5	2719 0	41·2
1 ,, 18	1 ,, 15·39	1 ,, 11·70	1 ,, 9·80	46 10	123 9	213 5	264 1	3049 0	46·2


4 ft. 8½ in. Gauge. Diagram No. 3.
Right and Left.
Right Hand.
Three-Throws, requiring one Set of Three-throw Switches and three Crossings.
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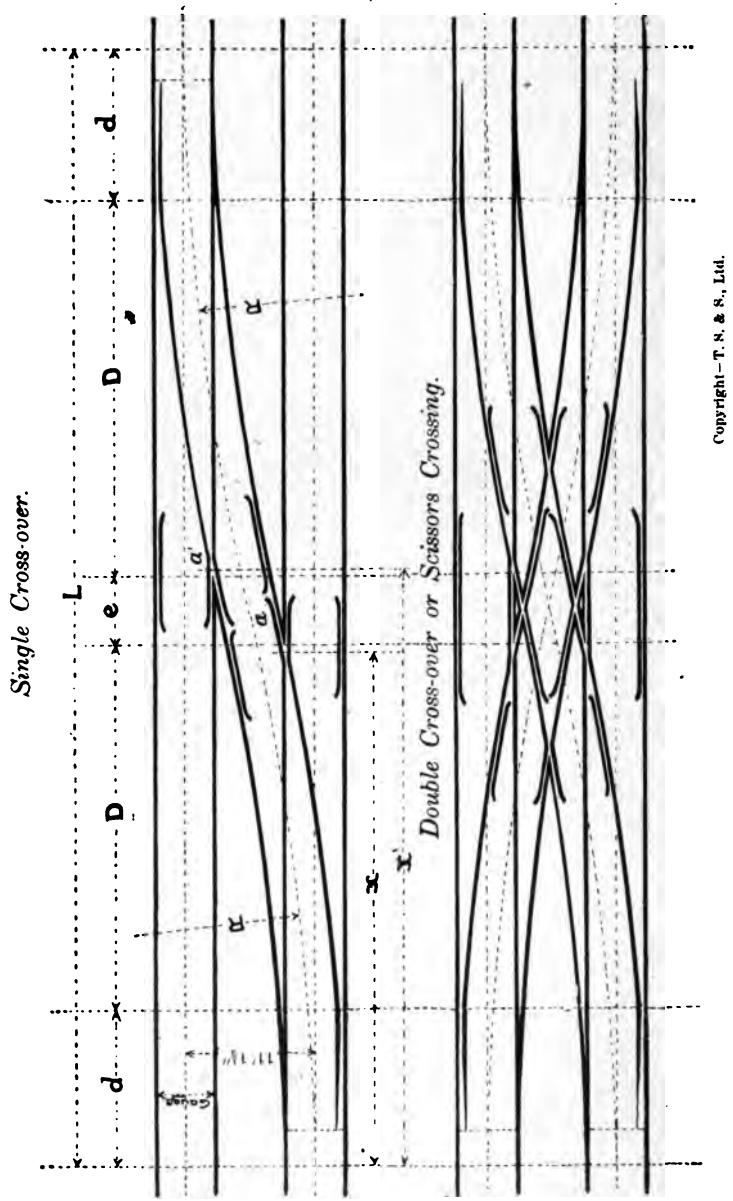
THREE THROWS.

4 ft. 8½ in. Gauge. Table No. 3.

Angle of Crossings. a a¹	Angle of Crossing. b	Spring of Curve to Heel of Switches. a		Heel of Switches to Nose of Crossings. D		Heel of Switches to Nose of Crossing. K		Radius of Inside Curve. r		Nose of Crossing to Heel of Switches. b		Angle of Crossings. a a¹	Angle of Crossing. b	Spring of Curve to Heel of Switches. d		Heel of Switches to Nose of Cro ssings. D		Heel of Switches to Nose of Crossing. K		Radius of Inside Curve. r		Radius of Curve in feet. R		Radius of Curve in chains. R
		Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.			Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	
I in 1¾	I in 1'21	4	6¼	12	0¾	7	5	14	6	29	0	'44	I in 7½	19	6	51	7	30	9	265	0	529	0	8'01
I „ 2	I „ 1'39	5	2¼	13	9¼	8	4¾	18	9	37	6	'57	I „ 8	20	10	55	0	32	10	301	0	602	0	9'12
I „ 2½	I „ 1'57	5	9¾	15	6	9	5	23	9	47	6	'72	I „ 8½	22	1	58	6	34	11	340	0	680	0	10'30
I „ 2½	I „ 1'75	6	6	17	2¼	10	5	29	6	59	0	'89	I „ 9	23	5	61	11	36	11	381	0	762	0	11'54
I „ 2¾	I „ 1'93	7	1½	18	11½	11	5¼	35	6	71	0	1'01	I „ 9½	24	9	65	4	39	0	425	0	849	0	12'86
I „ 3	I „ 2'10	7	10	20	7	12	5	42	6	84	6	1'28	I „ 10	26	0	68	9	41	0	471	0	941	0	14'26
I „ 3¼	I „ 2'28	8	5½	22	4½	13	5½	50	0	99	6	1'51	I „ 10½	27	4	72	2	43	1	519	0	1037	0	15'71
I „ 3½	I „ 2'46	9	1¼	24	0¾	14	5½	58	0	116	0	1'75	I „ 11	28	7	75	8	45	1	570	0	1139	0	17'25
I „ 3¾	I „ 2'61	9	9	25	9½	15	5½	66	6	133	0	2'01	I „ 11½	29	11	79	1	47	2	622	0	1244	0	18'83
I „ 4	I „ 2'82	10	4¾	27	6	16	5½	75	6	151	0	2'3	I „ 12	31	3	82	6	49	2	678	0	1355	0	20'53
I „ 4¼	I „ 3'00	11	0½	29	3	17	6½	85	0	170	0	2'57	I „ 12½	32	6	85	11	51	3	735	0	1470	0	22'27
I „ 4½	I „ 3'17	11	8½	30	11½	18	6½	95	0	191	0	2'89	I „ 13	33	10	89	5	53	4	795	0	1590	0	24'09
I „ 4¾	I „ 3'34	12	4	32	8	19	6½	106	0	212	0	3'21	I „ 14	36	5	96	3	57	5	922	0	1844	0	27'94
I „ 5	I „ 3'52	13	0	34	5	20	7	118	0	235	0	3'56	I „ 15	39	0	103	2	61	6	1059	0	2117	0	32'07
I „ 5½	I „ 3'88	14	3½	37	10	22	7½	143	0	285	0	4'31	I „ 16	41	8	110	0	65	7	1205	0	2409	0	36'5
I „ 6	I „ 4'23	15	7½	41	3	24	7½	170	0	339	0	5 13	I „ 17	44	3	116	11	69	8	1360	0	2719	0	41'2
I „ 6½	I „ 4'58	16	11	44	8½	26	8	199	0	398	0	6'03	I „ 18	46	10	123	9	73	9	1525	0	3049	0	46'2
I „ 7	I „ 4'94	18	2½	48	3	28	8½	231	0	461	0	6'98												

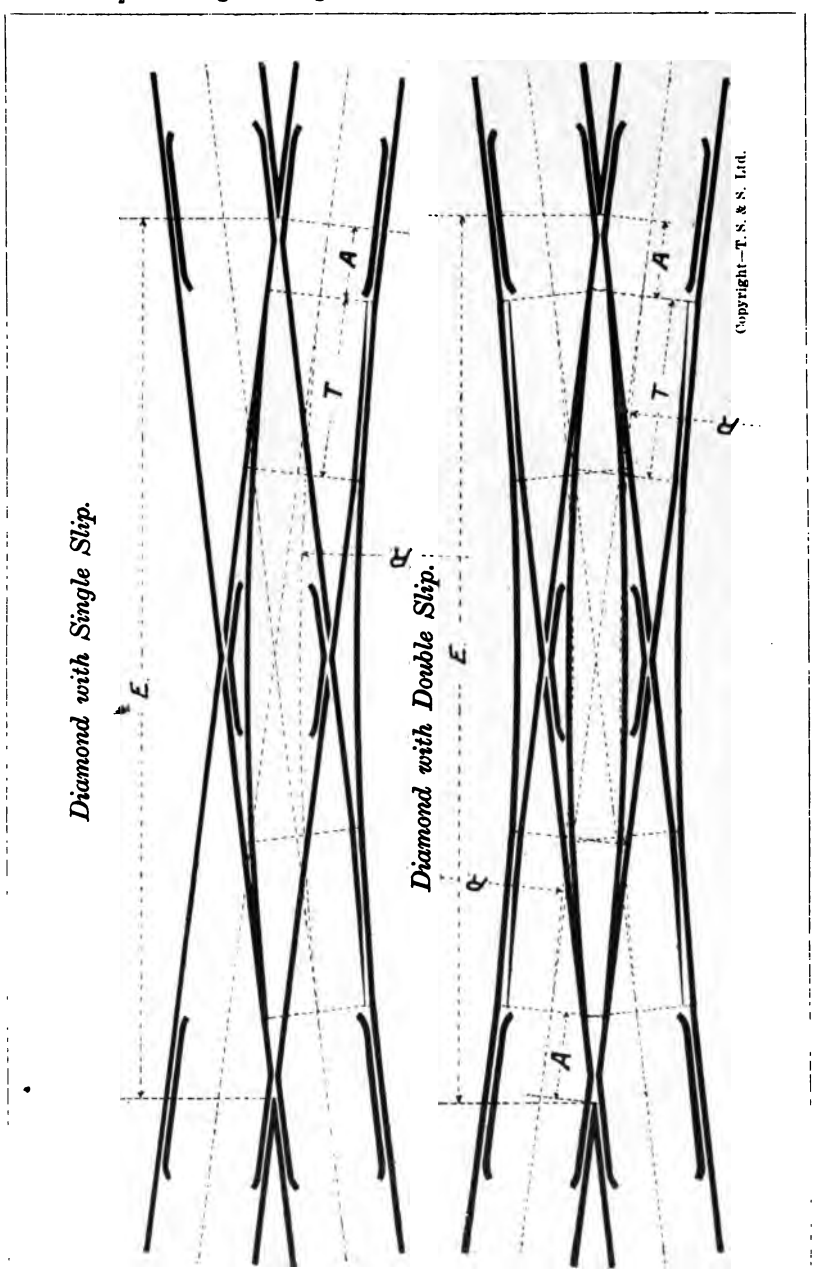


4 ft. 8½ in. Gauge. Diagram No. 4.

SINGLE AND DOUBLE CROSS-OVERS.

4 ft. 8½ in. Gauge. Table No. 4.

Angle of Crossings. a a¹	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a¹	e Nose to Nose of Crossings.	x Spring of Curve to intersection of Gauge Lines at Crossing a.	x¹ Spring of Curve to intersection of Gauge Lines at Crossing a¹	L Spring of Curve to Spring of Curve.	R Radius of Curve in feet.	R Radius of Curve in chains.	Angle of Crossings. a a¹	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a¹	e Nose to Nose of Crossings.	x Spring of Curve to intersection of Gauge Lines at Crossing a.	x¹ Spring of Curve to intersection of Gauge Lines at Crossing a¹	L Spring of Curve to Spring of Curve.	R Radius of Curve in feet.	R Radius of Curve in chains.
1 in 14	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.		1 in 7½	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	F.. Ins.	Ft. Ins.	
1 ,, 2	4 6½	12 0¾	0 10½	1 5 5¾	34 0½	29 0	.44		1 ,, 8	19 6	51 7	10 11	70 8	82 5	153 1	589 0	8·01
1 ,, 2½	5 2½	13 9¼	1 5¾	2 0¾	39 4½	37 6	.57		1 ,, 8½	20 10	55 0	11 8	75 4½	88 0	163 4	602 0	9·12
1 ,, 2½	5 9½	15 6	2 6¾	2 6 6¼	44 8	47 6	.72		1 ,, 9	22 1	58 6	12 5	80 1	93 6	173 7	686 0	10·30
1 ,, 2½	6 6	17 2¼	2 6¾	2 6 6¾	49 11	59 0	.89		1 ,, 9½	23 5	61 11	13 2	84 10	99 0	183 10	762 0	11·54
1 ,, 2¾	7 1½	18 11½	3 0 5¼	2 10¾	55 1¼	71 0	1·01		1 ,, 9¾	24 9	65 4	14 0	89 6	104 7	194 1	849 0	12·86
1 ,, 3	7 10	20 7	3 5¼	2 11 6¼	60 4	84 6	1·28		1 ,, 10	26 0	68 9	14 9	94 2	110 1	204 4	941 0	14·26
1 ,, 3½	8 5½	22 4½	4 4½	3 7¼	65 7¾	99 6	1·51		1 ,, 10½	27 4	72 2	15 7	98 11	115 8	214 7	1037 0	15·71
1 ,, 3½	9 1¼	24 0½	4 9½	3 8¾	70 8¾	116 0	1·75		1 ,, 11	28 7	75 8	16 4	103 8	121 2	224 10	1139 0	17·25
1 ,, 3¾	9 9	25 9½	5 3 6	3 10½	75 10½	133 0	2·01		1 ,, 11½	29 11	79 1	17 1	108 4	126 9	235 1	1244 0	18·83
1 ,, 4	10 4½	27 6	5 8	4 0	81 1	151 0	2·3		1 ,, 12	31 3	82 6	17 10	113 1	132 3	245 4	1355 0	20·53
1 ,, 4½	11 0½	29 3	5 11 6¾	4 1½	86 3	170 0	2·57		1 ,, 12½	32 6	85 11	18 7	117 9	137 10	255 7	1470 0	22·27
1 ,, 4½	11 8½	30 11½	6 0 7	4 2½	91 4	191 0	2·89		1 ,, 13	33 10	89 5	19 4	122 6	143 4	265 9	1590 0	24·09
1 ,, 4¾	12 4	32 8	6 6 6	4 4½	96 6	212 0	3·21		1 ,, 13½	36 5	96 3	20 11	131 11	154 5	286 3	1844 0	27·94
1 ,, 5	13 0	34 5	6 11 7 8½	4 9½	101 8	235 0	3·56		1 ,, 13¾	39 0	103 2	22 5	141 4	165 5	306 9	2117 0	32·07
1 ,, 5½	14 3½	37 10	7 8½	5 2	112 0	285 0	4·31		1 ,, 14	41 8	110 0	23 11	150 9	176 6	327 3	2409 0	36·5
1 ,, 5½	15 7½	41 3	7 11 6½	5 3	122 3	339 0	5·13		1 ,, 14½	44 3	116 11	25 5	160 2	187 7	347 9	2719 0	41·2
1 ,, 6	16 11	44 8½	8 4 6	5 9	132 6	390 0	6·01		1 ,, 15	46 10	123 9	27 0	169 7	198 7	368 2	3049 0	46·2
1 ,, 6½	18 2½	48 3	9 4 11	5 11 3	142 9	461 0	6·98		1 ,, 15½								
1 ,, 7			10 11	6 5 11¾					1 ,, 16								



4 ft. 8½ in. Gauge. Diagram No. 5.

Table No. 5.

DIAMONDS WITH SINGLE AND DOUBLE SLIPS.

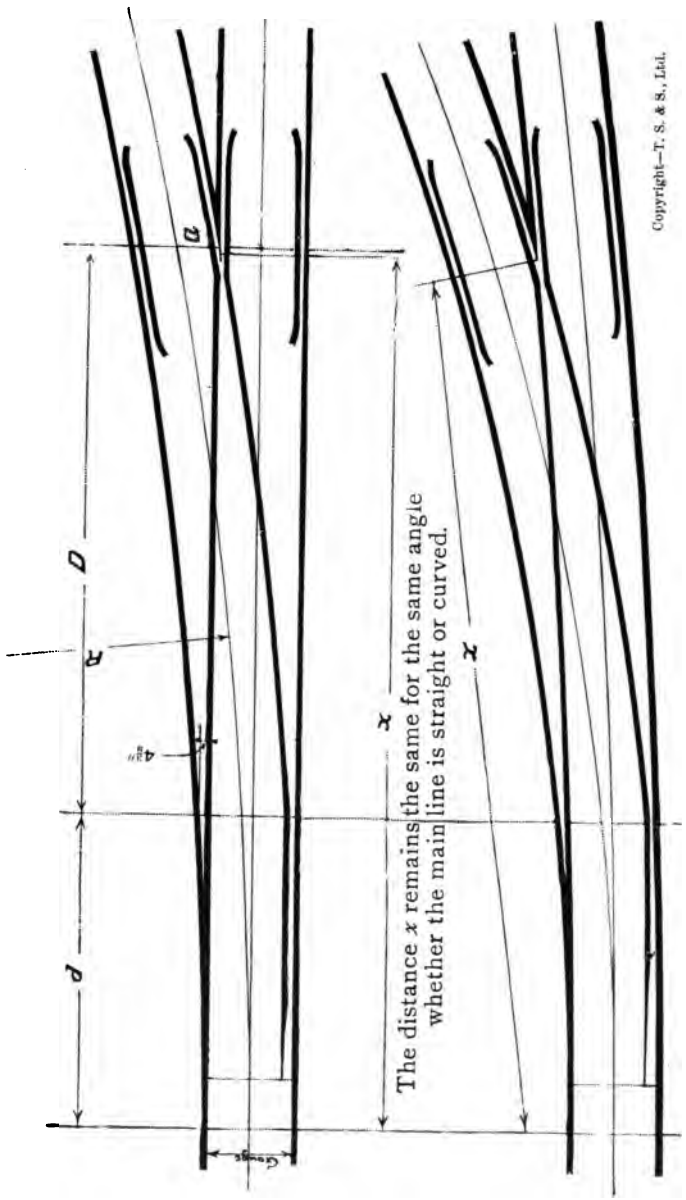
4 ft. 8½ in. Gauge.

SINGLE SLIP.

Angle of Diamond.	R Maximum Radius of Slip in feet.	R Maximum Radius of Slip in chains.	A Minimum Distance Nose of Crossing to Point of Switch.	T Length of Tongue.	E Nose to Nose of Crossings.	Angle of Diamond.	R Maximum Radius of Slip in feet.	R Maximum Radius of Slip in chains.	A Minimum Distance Nose of Crossing to Point of Switch.	T Length of Tongue.	E Nose to Nose of Crossings.
	Ft. Ins.		Ft. Ins.	Ft. Ins.	Ft. Ins.		Ft. Ins.		Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 3	87 6	1·32	1 8	6 0	28 11 25/50	1 in 7	520 0	7·87	3 11	12 0	66 10
1 in 4	160 0	2·42	2 3	7 6	37 7	1 in 8	720 0	10·90	4 5½	12 0	76 4
1 in 5	260 0	3·93	2 9½	9 0	47 10 38/50	1 in 9	920 0	13·93	5 0	12 0	85 8¼
1 in 6	380 0	5·75	3 4	9 0	57 3¾	1 in 10	1080 0	16·36	5 7	15 0	95 2½

DOUBLE SLIP.

Angle of Diamond.	R Maximum Radius of Slip in feet.	R Maximum Radius of Slip in chains.	A Minimum Distance Nose of Crossing to Point of Switch.	T Length of Tongue.	E Nose to Nose of Crossings.	Angle of Diamond.	R Maximum Radius of Slip in feet.	R Maximum Radius of Slip in chains.	A Minimum Distance Nose of crossing to Point of Switch.	T Length of Tongue.	E Nose to Nose of Crossings.
	Ft. Ins.		Ft. Ins.	Ft. Ins.	Ft. Ins.		Ft. Ins.		Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 3	77 6	1·17	2 11	6 0	28 11 25/50	1 in 7	460 0	6·97	6 10	12 0	66 10
1 in 4	150 0	2·27	3 11	7 6	37 7	1 in 8	640 0	9·69	7 9½	12 0	76 4
1 in 5	230 0	3·48	4 10½	9 0	47 10 38/50	1 in 9	800 0	12·12	8 9	12 0	85 8¼
1 in 6	360 0	5·45	5 10	9 0	57 3¾	1 in 10	1000 0	15·15	9 9	15 0	95 2½



Single Junction requiring one Set of Switches and Crossings.

5 ft. 3 in. Gauge. Diagram No. 1.

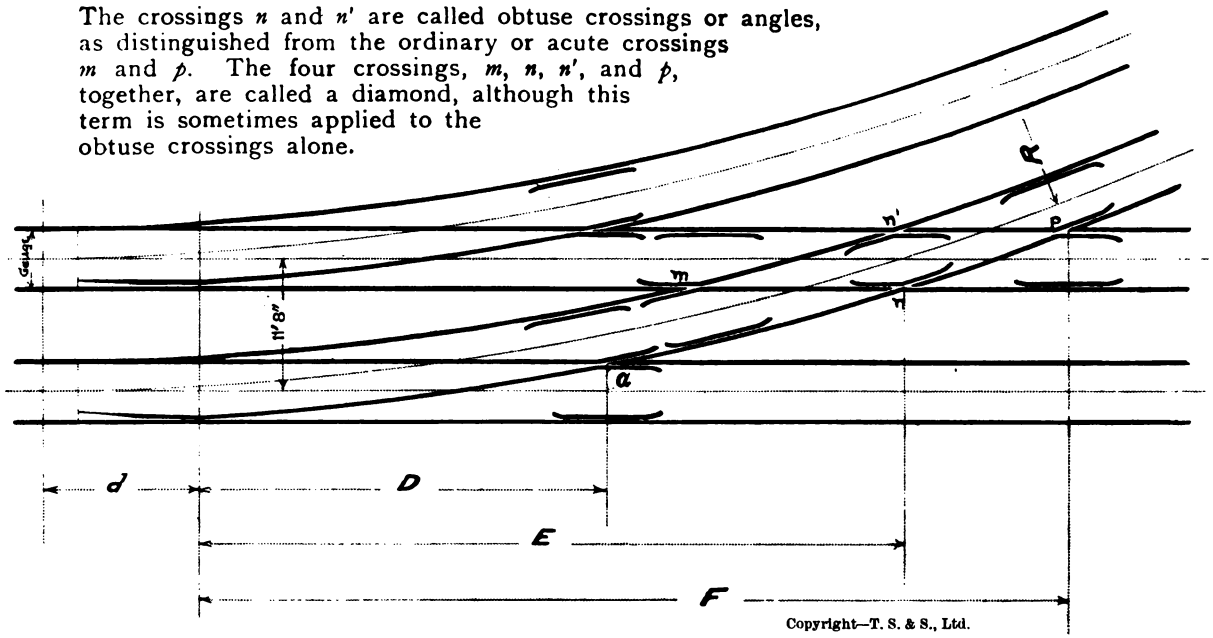
SINGLE JUNCTIONS.

5 ft. 3 in. Gauge. Table No. 1.

Angle of Crossing. a In Units.	Angle of Crossing. a In Degrees.	Spring of Curve to Heel of Switches. d		Heel of Switches to Nose of Crossing. D		Spring of Curve to intersection of Gauge Lines. x		Radius of Curve. R		Angle of Crossing. a In Units.	Angle of Crossing. a In Degrees.	Spring of Curve to Heel of Switches. d		Heel of Switches to Nose of Crossing. D		Spring of Curve to intersection of Gauge Lines. x		Radius of Curve. R	
		Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.		Deg. Min.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in $1\frac{3}{4}$	31 52	4	$9\frac{1}{2}$	13	$8\frac{1}{2}$	18	$4\frac{1}{2}$	32	6	1 in $7\frac{1}{2}$	7 38	20	7	58	7	78	9	591	0
1 ,, 2	28 4	5	$5\frac{3}{4}$	15	$7\frac{3}{4}$	21	0	42	0	1 ,, 8	7 10	22	0	62	$5\frac{1}{2}$	84	0	672	0
1 ,, $2\frac{1}{4}$	25 4	6	2	17	6	23	$7\frac{1}{2}$	53	6	1 ,, $8\frac{1}{2}$	6 44	23	4	66	5	89	3	759	0
1 ,, $2\frac{1}{2}$	22 38	6	$10\frac{1}{4}$	19	$6\frac{1}{2}$	26	3	66	0	1 ,, 9	6 22	24	9	70	3	94	6	851	0
1 ,, $2\frac{3}{4}$	20 36	7	$6\frac{1}{2}$	21	$5\frac{3}{4}$	28	$10\frac{1}{2}$	79	6	1 ,, $9\frac{1}{2}$	6 2	26	1	74	3	99	9	948	0
1 ,, 3	18 54	8	3	23	$5\frac{1}{4}$	31	6	94	6	1 ,, 10	5 44	27	6	78	1	105	0	1050	0
1 ,, $3\frac{1}{4}$	17 26	8	11	25	5	34	$1\frac{1}{2}$	111	0	1 ,, $10\frac{1}{2}$	5 26	28	10	82	0	110	3	1158	0
1 ,, $3\frac{1}{2}$	16 16	9	$7\frac{1}{4}$	27	$4\frac{1}{4}$	36	9	129	0	1 ,, 11	5 12	30	3	85	11	115	6	1271	0
1 ,, $3\frac{3}{4}$	15 12	10	$3\frac{1}{2}$	29	$3\frac{3}{4}$	39	$4\frac{1}{2}$	148	0	1 ,, $11\frac{1}{2}$	4 58	31	7	89	10	120	9	1389	0
1 ,, 4	14 14	11	0	31	$2\frac{3}{4}$	42	0	168	0	1 ,, 12	4 46	33	0	93	8	126	0	1572	0
1 ,, $4\frac{1}{4}$	13 26	11	8	33	$2\frac{1}{2}$	44	$7\frac{1}{2}$	190	0	1 ,, $12\frac{1}{2}$	4 36	34	4	97	7	131	3	1641	0
1 ,, $4\frac{1}{2}$	12 40	12	$4\frac{1}{2}$	35	$1\frac{1}{2}$	47	3	213	0	1 ,, 13	4 24	35	9	101	6	136	6	1775	0
1 ,, $4\frac{3}{4}$	12 2	13	$0\frac{1}{2}$	37	$1\frac{1}{2}$	49	$10\frac{1}{2}$	237	0	1 ,, 14	4 6	38	6	109	4	147	0	2058	0
1 ,, 5	11 26	13	9	39	$0\frac{1}{2}$	52	6	263	0	1 ,, 15	3 50	41	3	117	1	157	6	2363	0
1 ,, $5\frac{1}{2}$	10 24	15	$1\frac{1}{2}$	42	$11\frac{1}{2}$	57	9	318	0	1 ,, 16	3 34	44	0	124	11	168	0	2688	0
1 ,, 6	9 32	16	$5\frac{1}{2}$	46	11	63	0	378	0	1 ,, 17	3 22	46	9	132	9	178	6	3035	0
1 ,, $6\frac{1}{2}$	8 48	17	$10\frac{1}{2}$	50	9	68	3	444	0	1 ,, 18	3 10	49	6	140	7	189	0	3402	0
1 ,, 7	8 10	19	3	54	8	73	6	515	0										

Double Junction, requiring two Sets of Switches and Crossings, and one Diamond.

The crossings *n* and *n'* are called obtuse crossings or angles, as distinguished from the ordinary or acute crossings *m* and *p*. The four crossings, *m*, *n*, *n'*, and *p*, together, are called a diamond, although this term is sometimes applied to the obtuse crossings alone.



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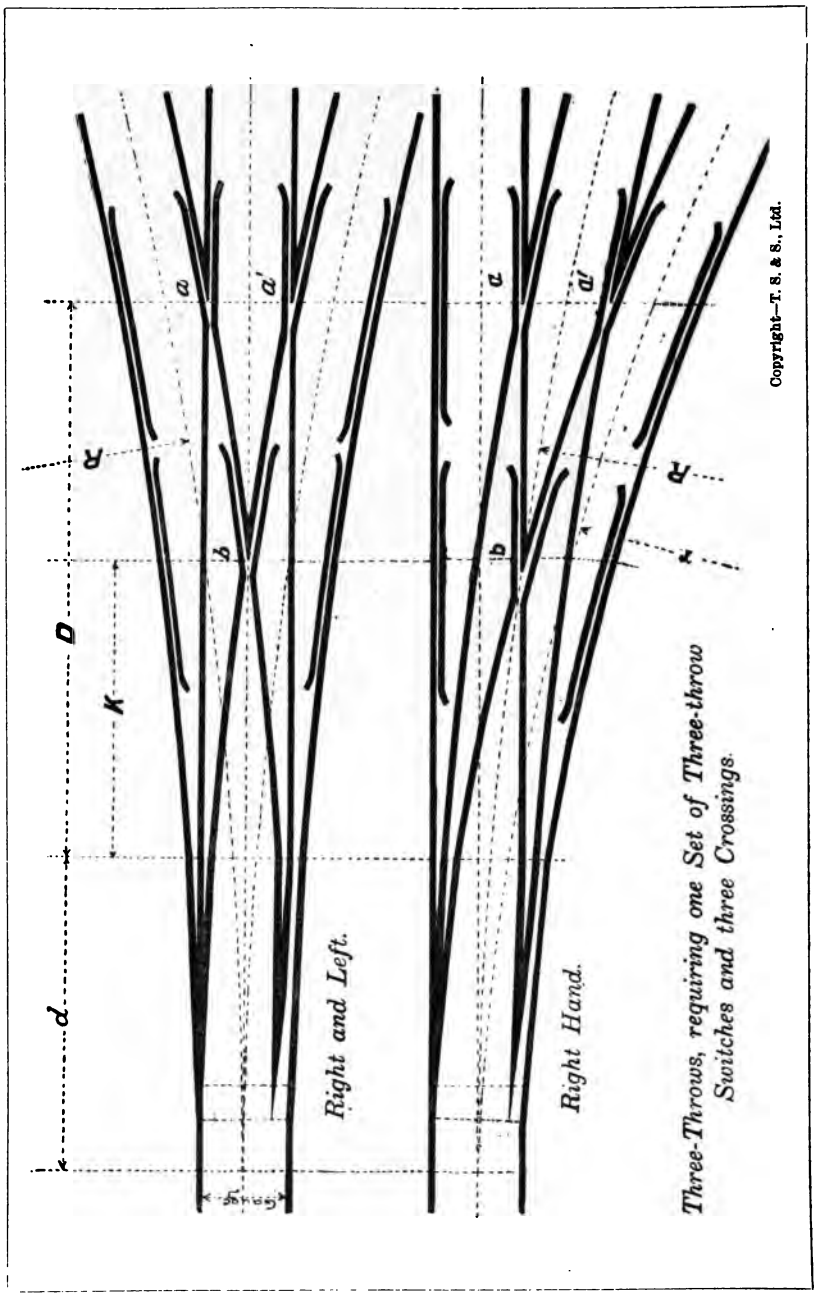
5 ft. 3 in. Gauge. Diagram No. 2.

DOUBLE JUNCTIONS.

5 ft. 3 ins. Gauge. Table No. 2.

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossing. n	Angle of Crossing. n1	Angle of Crossing. p	Spring of Curve to Heel of Switches. d	Heel of Switches to Nose of Crossing. D	Heel of Switches to Knees of Crossing. E	Heel of Switches to Nose of Crossing. F	Radius of Curve. R
1 in 14¼	1 in 1'43	1 in 1'11	1 in 1'01	1 in .88	Ft. Ins. 4 9½	Ft. Ins. 13 8½	Ft. Ins. 21 2½	Ft. Ins. 25 0¾	Ft. Ins. 32 6
1 ,, 2	1 ,, 1'68	1 ,, 1'29	1 ,, 1'20	1 ,, 1'03	5 5⅝	15 7¼	24 7	29 6⅝	42 0
1 ,, 2¼	1 ,, 1'92	1 ,, 1'46	1 ,, 1'38	1 ,, 1'18	6 2	17 6	27 11¼	33 10⅝	53 6
1 ,, 2½	1 ,, 2'16	1 ,, 1'64	1 ,, 1'57	1 ,, 1'33	6 10½	19 6½	31 3¼	38 2¼	66 0
1 ,, 2¾	1 ,, 2'39	1 ,, 1'81	1 ,, 1'74	1 ,, 1'47	7 6½	21 5¾	34 7	42 5	79 6
1 ,, 3	1 ,, 2'63	1 ,, 1'98	1 ,, 1'92	1 ,, 1'62	8 3	23 5¾	37 10⅜	46 7¼	94 6
1 ,, 3¼	1 ,, 2'86	1 ,, 2'15	1 ,, 2'09	1 ,, 1'76	8 11	25 5	41 2⅝	50 9¼	111 0
1 ,, 3½	1 ,, 3'09	1 ,, 2'32	1 ,, 2'27	1 ,, 1'90	9 7¼	27 4¼	44 5¾	54 11	129 0
1 ,, 3¾	1 ,, 3'32	1 ,, 2'49	1 ,, 2'44	1 ,, 2'05	10 3½	29 3¼	47 8¾	59 0½	148 0
1 ,, 4	1 ,, 3'55	1 ,, 2'66	1 ,, 2'61	1 ,, 2'19	11 0	31 2¾	51 0	63 2	168 0
1 ,, 4¼	1 ,, 3'78	1 ,, 2'83	1 ,, 2'79	1 ,, 2'33	11 8	33 2⅛	54 3½	67 3¾	190 0
1 ,, 4½	1 ,, 4'01	1 ,, 3'00	1 ,, 2'96	1 ,, 2'47	12 4½	35 1⅝	57 6	71 4¾	213 0
1 ,, 4¾	1 ,, 4'24	1 ,, 3'16	1 ,, 3'13	1 ,, 2'61	13 0½	37 1⅜	60 9¼	75 5⅝	237 0
1 ,, 5	1 ,, 4'47	1 ,, 3'33	1 ,, 3'30	1 ,, 2'75	13 9	39 0⅞	64 0½	79 6¼	263 0
1 ,, 5¼	1 ,, 4'93	1 ,, 3'67	1 ,, 3'64	1 ,, 3'03	15 1⅝	42 11½	70 6⅝	87 8¾	318 0
1 ,, 6	1 ,, 5'38	1 ,, 4'01	1 ,, 3'98	1 ,, 3'32	16 5½	46 11	77 0	95 10⅜	378 0
1 ,, 6½	1 ,, 5'84	1 ,, 4'34	1 ,, 4'32	1 ,, 3'60	17 10½	50 9	83 6	104 0	444 0
1 ,, 7	1 ,, 6'30	1 ,, 4'68	1 ,, 4'66	1 ,, 3'88	19 3	54 8	89 11½	112 1⅛	515 0

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossing. n n1	Angle of Crossing. p	Spring of Curve to Heel of Switches. d	Heel of Switches to Nose of Crossing. D	Heel of Switches to Knees of Crossing. E	Heel of Switches to Nose of Crossing. F	Radius of Curve. R
1 in 7½	1 in 6'75	1 in 5'02	1 in 4'16	Ft. Ins. 20 7	Ft. Ins. 58 7	Ft. Ins. 96 5	Ft. Ins. 120 2	Ft. Ins. 591 0
1 ,, 8	1 ,, 7'20	1 ,, 5'35	1 ,, 4'44	22 0	62 5½	102 11	128 4	672 0
1 ,, 8½	1 ,, 7'66	1 ,, 5'69	1 ,, 4'72	23 4	66 5	109 4	136 5	759 0
1 ,, 9	1 ,, 8'11	1 ,, 6'03	1 ,, 5'00	24 9	70 3	115 10	144 6	851 0
1 ,, 9½	1 ,, 8'57	1 ,, 6'36	1 ,, 5'27	26 1	74 3	122 3	152 7	948 0
1 ,, 10	1 ,, 9'02	1 ,, 6'70	1 ,, 5'56	27 6	78 1	128 9	160 9	1050 0
1 ,, 10½	1 ,, 9'47	1 ,, 7'03	1 ,, 5'83	28 10	82 0	135 3	168 10	1158 0
1 ,, 11	1 ,, 9'93	1 ,, 7'37	1 ,, 6'11	30 3	85 11	141 8	176 11	1271 0
1 ,, 11½	1 ,, 10'38	1 ,, 7'70	1 ,, 6'39	31 7	89 10	148 2	185 0	1389 0
1 ,, 12	1 ,, 10'83	1 ,, 8'04	1 ,, 6'67	33 0	93 8	154 7	193 1	1572 0
1 ,, 12½	1 ,, 11'29	1 ,, 8'38	1 ,, 6'95	34 4	97 7	161 1	201 2	1641 0
1 ,, 13	1 ,, 11'74	1 ,, 8'71	1 ,, 7'23	35 9	101 6	167 6	209 3	1775 0
1 ,, 14	1 ,, 12'64	1 ,, 9'38	1 ,, 7'88	38 6	109 4	180 5	225 5	2058 0
1 ,, 15	1 ,, 13'55	1 ,, 10'05	1 ,, 8'34	41 3	117 1	193 4	241 7	2363 0
1 ,, 16	1 ,, 14'46	1 ,, 10'73	1 ,, 8'90	44 0	124 11	206 3	257 9	2688 0
1 ,, 17	1 ,, 15'36	1 ,, 11'40	1 ,, 9'46	46 9	132 9	219 2	273 10	3035 0
1 ,, 18	1 ,, 16'27	1 ,, 12'07	1 ,, 10'02	49 6	140 7	232 1	290 0	3402 0


5 ft. 3 in. Gauge. Diagram No. 3.
a
a'
b
D
K
d
R
Right and Left.
Right Hand.
Three-Throws, requiring one Set of Three-throw Switches and three Crossings.
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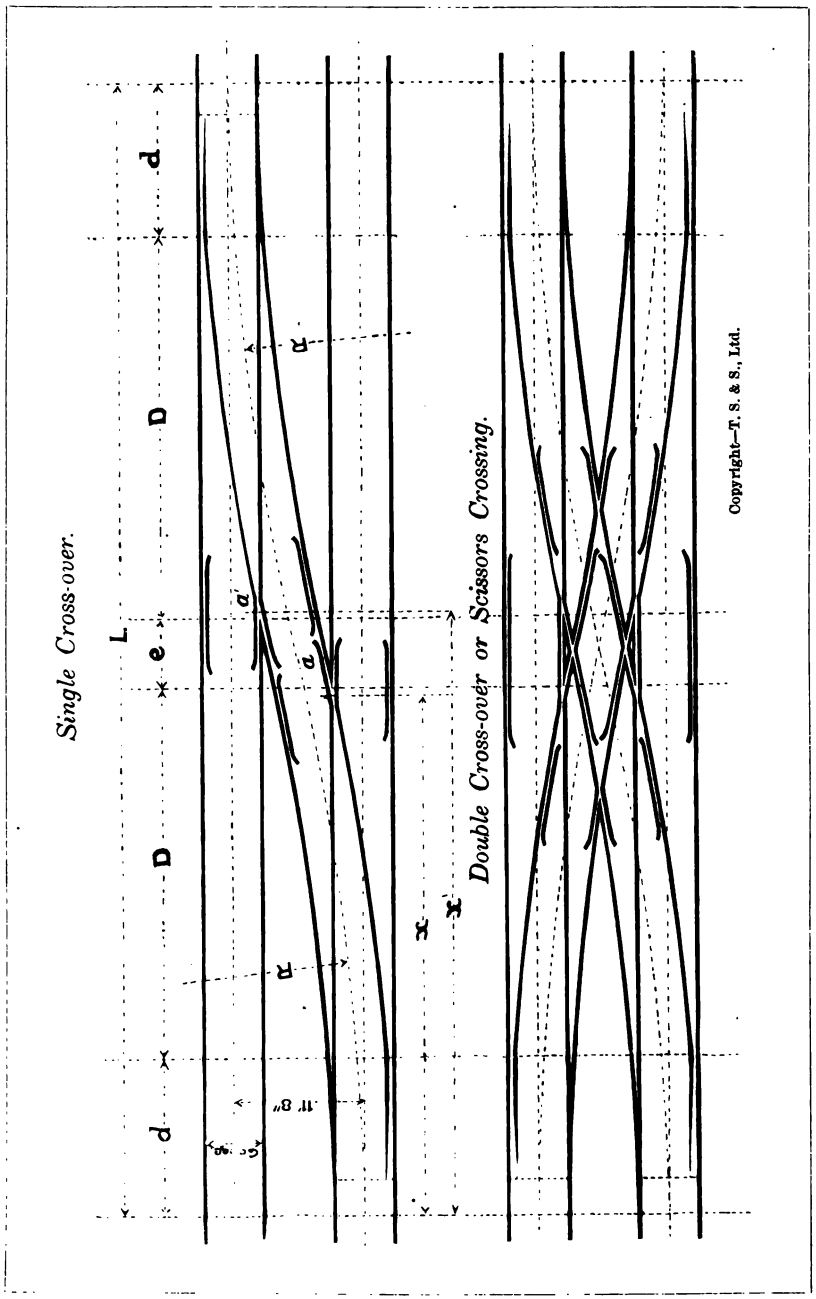
THREE THROWS.

5 ft. 3 in. Gauge. Table No. 3.

Angle of Crossings. a a¹	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a¹	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.	Angle of Crossings. a a¹	Angle of Crossing. b	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings. a a¹	K Heel of Switches to Nose of Crossing. b	r Radius of Inside Curve.	R Radius of Curve.
1 in 14	1 in 1'21	Ft. Ins. 4 9½	Ft. Ins. 13 8¼	Ft. Ins. 8 6¼	Ft. Ins. 16 3	Ft. Ins. 32 6	1 in 7½	1 in 5'29	Ft. Ins. 20 7	Ft. Ins. 58 7	Ft. Ins. 35 5½	Ft. Ins. 296 0	Ft. Ins. 591 0
1 ,, 2	1 ,, 1'39	5 5¾	15 7¾	9 8¾	21 0	42 0	1 ,, 8	1 ,, 5'65	22 0	62 5½	37 9½	336 0	672 0
1 ,, 2½	1 ,, 1'57	6 2	17 6	10 10	26 9	53 6	1 ,, 8½	1 ,, 6'00	23 4	66 5	40 2	380 0	759 0
1 ,, 2½	1 ,, 1'75	6 10¼	19 6½	11 11¾	33 0	66 0	1 ,, 9	1 ,, 6'36	24 9	70 3	42 6	426 0	851 0
1 ,, 2¾	1 ,, 1'93	7 6½	21 5¾	13 1¾	39 9	79 6	1 ,, 9½	1 ,, 6'71	26 1	74 3	44 10	474 0	948 0
1 ,, 3	1 ,, 2'10	8 3	23 5¼	14 3½	47 6	94 6	1 ,, 10	1 ,, 7'06	27 6	78 1	47 2	525 0	1050 0
1 ,, 3¼	1 ,, 2'28	8 11	25 5	15 5½	55 6	111 0	1 ,, 10½	1 ,, 7'42	28 10	82 0	49 7	579 0	1158 0
1 ,, 3½	1 ,, 2'46	9 7¼	27 4¼	16 7½	64 6	129 0	1 ,, 11	1 ,, 7'77	30 3	85 11	51 11	636 0	1271 0
1 ,, 3¾	1 ,, 2'64	10 3½	29 3½	17 9½	74 0	148 0	1 ,, 11½	1 ,, 8'12	31 7	89 10	54 3	695 0	1389 0
1 ,, 4	1 ,, 2'82	11 0	31 2¾	18 11½	84 0	168 0	1 ,, 12	1 ,, 8'48	33 0	93 8	56 7	786 0	1572 0
1 ,, 4¼	1 ,, 3'00	11 8	33 2¼	20 2	95 0	190 0	1 ,, 12½	1 ,, 8'84	34 4	97 7	59 0	821 0	1641 0
1 ,, 4½	1 ,, 3'17	12 4½	35 1¾	21 3½	107 0	213 0	1 ,, 13	1 ,, 9'19	35 9	101 6	61 4	888 0	1775 0
1 ,, 4¾	1 ,, 3'34	13 0½	37 1¼	22 6½	119 0	237 0	1 ,, 14	1 ,, 9'89	38 6	109 4	66 1	1029 0	2058 0
1 ,, 5	1 ,, 3'52	13 9	39 0¾	24 8	132 0	263 0	1 ,, 15	1 ,, 10'60	41 3	117 1	70 9	1182 0	2363 0
1 ,, 5½	1 ,, 3'88	15 1¼	42 11¾	26 0½	159 0	318 0	1 ,, 16	1 ,, 11'31	44 0	124 11	75 5	1344 0	2688 0
1 ,, 6	1 ,, 4'23	16 5½	46 11	28 4½	189 0	378 0	1 ,, 17	1 ,, 12'02	46 9	132 9	80 2	1518 0	3035 0
1 ,, 6½	1 ,, 4'58	17 10½	50 9	30 8½	222 0	444 0	1 ,, 18	1 ,, 12'72	49 6	140 7	84 11	1701 0	3402 0
1 ,, 7	1 ,, 4'94	19 3	54 8	33 1	258 0	515 0							



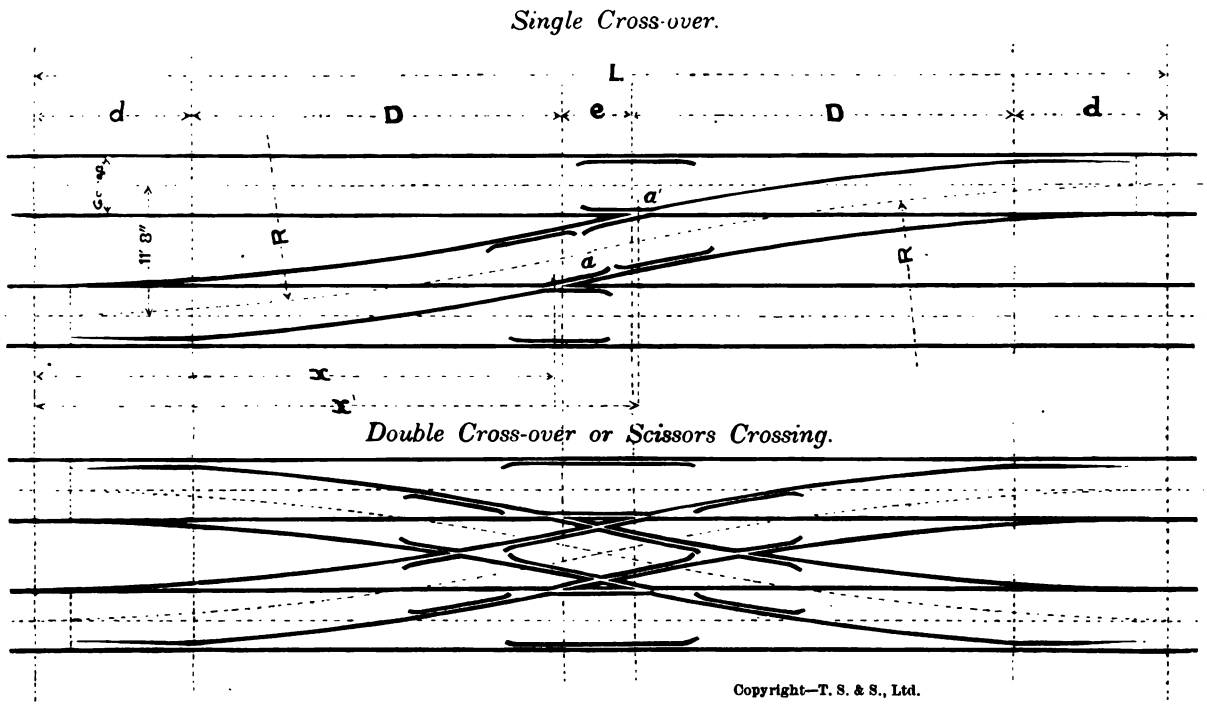
5 ft. 3 in. Gauge. Diagram No. 4.

SINGLE AND DOUBLE CROSS-OVERS.

5 ft. 3 in. Gauge. Table No. 4.

Angle of Crossings, a a¹	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings, a a¹	e Nose of Cross-ings, a a¹	x Spring of Curve to intersection of Gauge Lines at Crossing a.	x¹ Spring of Curve to intersection of Gauge Lines at Crossing a¹	L Spring of Curve to Spring of Curve.	R Radius of Curve.
	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 1⅔	4 9½	13 8½	0 5	18 4½	18 6	36 11	32 6
1 ,, 2	5 5½	15 7½	0 10	21 0	21 8	42 11	42 0
1 ,, 2½	6 2	17 6	1 3	23 7½	24 9	48 5	53 6
1 ,, 2¾	6 10½	19 6½	1 7½	26 3	27 10	54 1	66 0
1 ,, 3	7 6½	21 5½	1 11	28 10½	30 10	59 8½	79 6
1 ,, 3½	8 3	23 5½	2 4	31 6	33 10	65 4	94 6
1 ,, 3¾	8 11	25 5	2 8	34 1½	36 10	70 11½	111 0
1 ,, 3¾	9 7½	27 4½	2 11	36 9	39 10	76 7	129 0
1 ,, 3¾	10 3½	29 3½	3 3	39 4½	42 9½	82 2	148 0
1 ,, 4	11 0	31 2½	3 7	42 0	45 9	87 9	168 0
1 ,, 4¼	11 8	33 2½	3 10	44 7½	48 8	93 4	190 0
1 ,, 4½	12 4½	35 1½	4 2	47 3	51 8	98 11	213 0
1 ,, 4¾	13 0½	37 1½	4 5	49 10½	54 7	104 6	237 0
1 ,, 4¾	13 9	39 0½	4 9	52 6	57 6	110 0	263 0
1 ,, 5	14 5½	42 11½	5 0½	57 9	63 5	121 2	318 0
1 ,, 5½	15 1½	46 11	5 7	63 0	69 3	132 4	378 0
1 ,, 6	16 5½	50 9	6 2	68 3	75 2	143 5	444 0
1 ,, 6½	17 10½	54 8	6 8	73 6	81 0	154 5	515 0
1 ,, 7	19 3						

Angle of Crossings, a a¹	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings, a a¹	e Nose to Nose of Crossings, a a¹	x Spring of Curve to intersection of Gauge Lines at Crossing a.	x¹ Spring of Curve to intersection of Gauge Lines at Crossing a¹	L Spring of Curve to Spring of Curve.	R Radius of Curve.
	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 7½	20 7	58 7	7 3	78 9	86 11	165 7	591 0
1 ,, 8	22 0	62 5½	7 9	84 0	92 9	176 8	672 0
1 ,, 8½	23 4	66 5	8 4	89 3	98 7	187 9	759 0
1 ,, 9	24 9	70 3	8 10	94 6	104 5	198 10	851 0
1 ,, 9½	26 1	74 3	9 4	99 9	110 3	209 11	948 0
1 ,, 10	27 6	78 1	9 11	105 0	116 1	221 0	1050 0
1 ,, 10½	28 10	82 0	10 5	110 3	121 11	232 1	1158 0
1 ,, 11	30 3	85 11	10 11	115 6	127 9	243 2	1271 0
1 ,, 11½	31 7	89 10	11 6	120 9	133 7	254 3	1389 0
1 ,, 12	33 0	93 8	12 0	126 0	139 5	265 4	1572 0
1 ,, 12½	34 4	97 7	12 6	131 3	145 3	276 5	1641 0
1 ,, 13	35 9	101 6	13 0	136 6	151 1	287 6	1775 0
1 ,, 14	38 6	109 4	14 1	147 0	162 8	309 8	2058 0
1 ,, 15	41 3	117 1	15 1	157 6	174 4	331 10	2363 0
1 ,, 16	44 0	124 11	16 2	168 0	186 0	353 11	2688 0
1 ,, 17	46 9	132 9	17 2	178 6	197 8	376 1	3035 0
1 ,, 18	49 6	140 7	18 2	189 0	209 2	398 2	3402 0



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5 ft. 3 in. Gauge. Diagram No. 4.

SINGLE AND DOUBLE CROSS-OVERS.

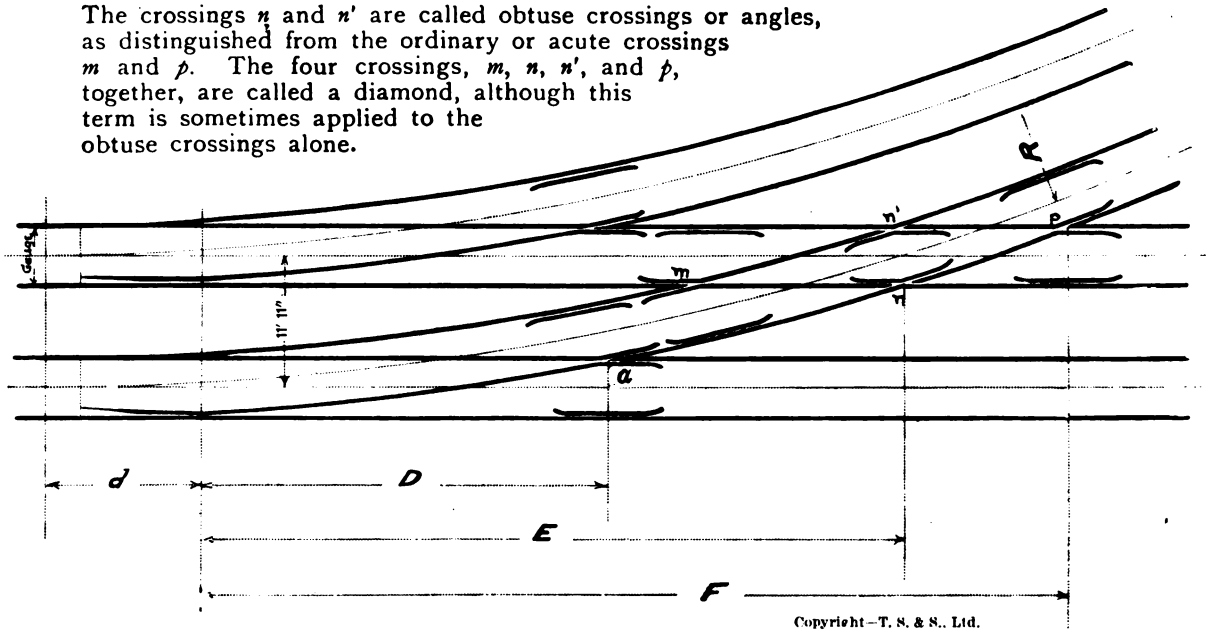
5 ft. 3 in. Gauge. Table No. 4.

Angle of Crossings, a a¹	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings, a a¹	e Nose to Nose of Cro-sings, a a¹	f Spring of Curve to intersection of Gauge Lines at Crossing a.	f¹ Spring of Curve to intersection of Gauge Lines at Crossing a¹	L Spring of Curve to Spring of Curve.	R Radius of Curve.
	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 11	4 9½	13 8½	—	18 4½	18 6	36 11	32 6
1 ,, 2	5 5½	15 7½	0 5	21 0	21 8	42 11	42 0
1 ,, 2½	6 2	17 6	0 10½	23 7½	24 9	48 5	53 6
1 ,, 2¾	6 10½	19 6½	1 3½	26 3	27 10	54 1	66 0
1 ,, 2¾	7 6½	21 5½	1 7½	28 10½	30 10	59 8½	79 6
1 ,, 3	8 3	23 5½	1 11½	31 6	33 10	65 4	94 6
1 ,, 3¼	8 11	25 5	2 4	34 1½	36 10	70 11½	111 0
1 ,, 3½	9 7½	27 4½	2 8	36 9	39 10	76 7	129 0
1 ,, 3¾	10 3½	29 3½	2 11½	39 4½	42 9½	82 2	148 0
1 ,, 4	11 0	31 2½	3 3½	42 0	45 9	87 9	168 0
1 ,, 4¼	11 8	33 2½	3 7	44 7½	48 8	93 4	190 0
1 ,, 4½	12 4½	35 1½	3 10½	47 3	51 8	98 11	213 0
1 ,, 4¾	13 1½	37 1½	4 2	49 10½	54 7	104 6	237 0
1 ,, 5	13 9	39 0½	4 5½	52 6	57 6	110 0	263 0
1 ,, 5½	15 1½	42 11½	5 0½	57 9	63 5	121 2	318 0
1 ,, 6	16 5½	46 11	5 7	63 0	69 3	132 4	378 0
1 ,, 6½	17 10½	50 9	6 2	68 3	75 2	143 5	444 0
1 ,, 7	19 3	54 8	6 8	73 6	81 0	154 5	515 0

Angle of Crossings, a a¹	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings, a a¹	e Nose to Nose of Crossings, a a¹	f Spring of Curve to intersection of Gauge Lines at Crossing a.	f¹ Spring of Curve to intersection of Gauge Lines at Crossing a¹	L Spring of Curve to Spring of Curve.	R Radius of Curve.
	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 7½	20 7	58 7	7 3	78 9	86 11	165 7	591 0
1 ,, 8	22 0	62 5½	7 9	84 0	92 9	176 8	672 0
1 ,, 8½	23 4	66 5	8 4	89 3	98 7	187 9	759 0
1 ,, 9	24 9	70 3	8 10	94 6	104 5	198 10	851 0
1 ,, 9½	26 1	74 3	9 4	99 9	110 3	209 11	948 0
1 ,, 10	27 6	78 1	9 11	105 0	116 1	221 0	1050 0
1 ,, 10½	28 10	82 0	10 5	110 3	121 11	232 1	1158 0
1 ,, 11	30 3	85 11	10 11	115 6	127 9	243 2	1271 0
1 ,, 11½	31 7	89 10	11 6	120 9	133 7	254 3	1389 0
1 ,, 12	33 0	93 8	12 0	126 0	139 5	265 4	1572 0
1 ,, 12½	34 4	97 7	12 6	131 3	145 3	276 5	1641 0
1 ,, 13	35 9	101 6	13 0	136 6	151 1	287 6	1775 0
1 ,, 14	38 6	109 4	14 1	147 0	162 8	309 8	2058 0
1 ,, 15	41 3	117 1	15 1	157 6	174 4	331 10	2363 0
1 ,, 16	44 0	124 11	16 2	168 0	186 0	353 11	2688 0
1 ,, 17	46 9	132 9	17 2	178 6	197 8	376 1	3035 0
1 ,, 18	49 6	140 7	18 2	189 0	209 2	398 2	3402 0

Double Junction, requiring two Sets of Switches and Crossings, and one Diamond.

The crossings *n* and *n'* are called obtuse crossings or angles, as distinguished from the ordinary or acute crossings *m* and *p*. The four crossings, *m*, *n*, *n'*, and *p*, together, are called a diamond, although this term is sometimes applied to the obtuse crossings alone.



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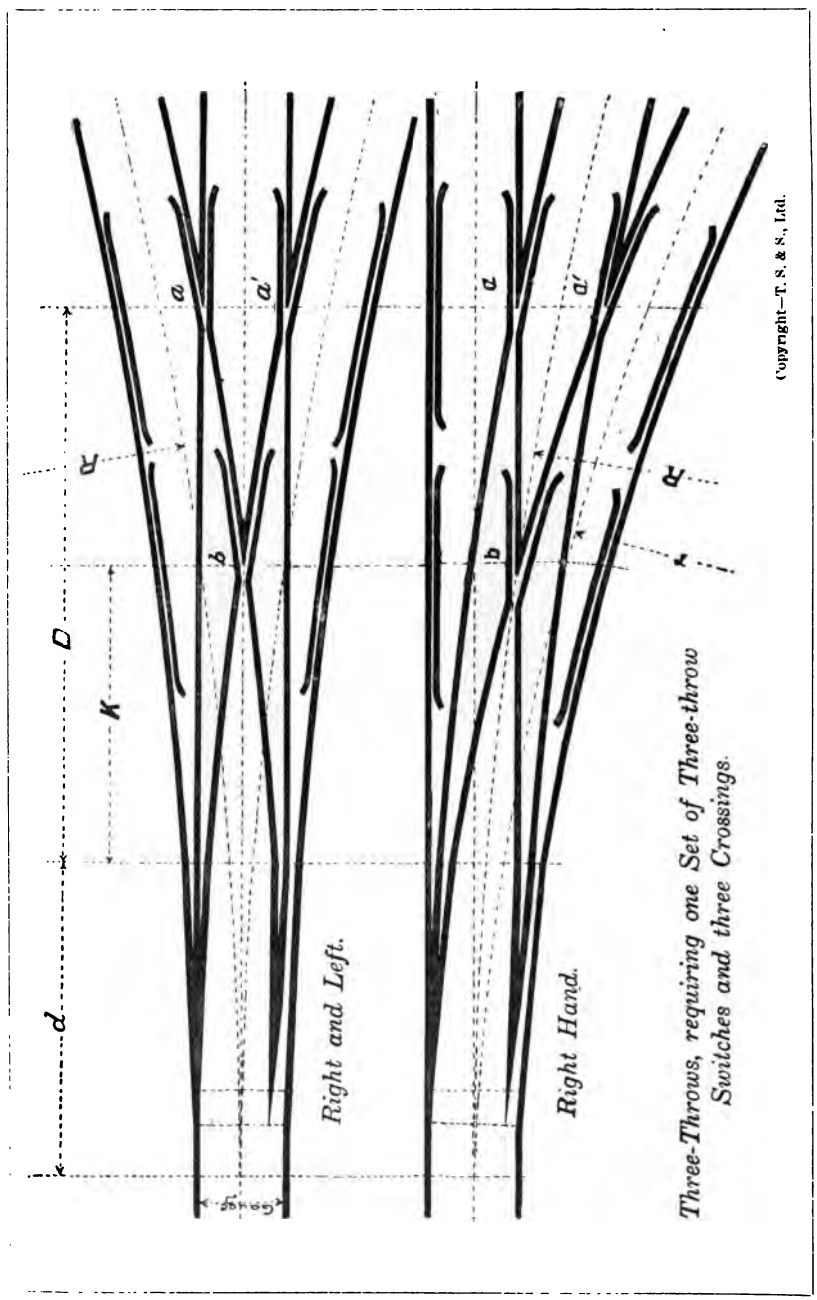
5 ft. 6 in. Gauge. Diagram No. 2.

DOUBLE JUNCTIONS.

5 ft. 6 in. Gauge. Table No. 2.

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossing. n	Angle of Crossing. n_1	Angle of Crossing. p	Spring of Curve to Heel of Switches. d	Heel of Switches to Nose of Crossing. D	Heel of Switches to Knees of Crossing. E	Heel of Switches to Nose of Crossing. F	Heel of Switches to Knees of Crossing. M	Heel of Switches to Nose of Crossing. P	Radius of Curve. R
1 in $1\frac{3}{4}$	1 in 1'47	1 in 1'13	1 in 1'02	1 in '89	Ft. Ins. 4 10	Ft. Ins. 14 6	Ft. Ins. 22 1	Ft. Ins. 26 3	Ft. Ins. 100 2	Ft. Ins. 125 6	Ft. Ins. 619 0
1 ,, 2	1 ,, 1'72	1 ,, 1'31	1 ,, 1'22	1 ,, 1'04	5 $6\frac{1}{2}$	16 7	22 $7\frac{1}{2}$	30 $10\frac{1}{2}$	66 $3\frac{1}{2}$	133 $1\frac{1}{2}$	704 0
1 ,, $2\frac{1}{4}$	1 ,, 1'97	1 ,, 1'48	1 ,, 1'40	1 ,, 1'19	6 $2\frac{1}{2}$	18 8	29 $1\frac{1}{2}$	35 54	70 5	142 5	795 0
1 ,, $2\frac{1}{2}$	1 ,, 2'21	1 ,, 1'66	1 ,, 1'59	1 ,, 1'34	6 11	20 $8\frac{1}{2}$	32 7	39 11	74 7	150 10	891 0
1 ,, $2\frac{3}{4}$	1 ,, 2'45	1 ,, 1'83	1 ,, 1'77	1 ,, 1'49	7 $7\frac{1}{2}$	22 $9\frac{1}{2}$	36 $0\frac{1}{4}$	44 $3\frac{1}{2}$	78 9	159 4	993 0
1 ,, 3	1 ,, 2'69	1 ,, 2'00	1 ,, 1'95	1 ,, 1'63	8 $3\frac{3}{8}$	24 $10\frac{1}{4}$	39 $5\frac{1}{4}$	48 $8\frac{1}{4}$	82 10	167 9	1100 0
1 ,, $3\frac{1}{4}$	1 ,, 2'93	1 ,, 2'17	1 ,, 2'12	1 ,, 1'78	9 0	26 11	42 $10\frac{1}{4}$	53 $0\frac{1}{4}$	87 0	176 3	1213 0
1 ,, $3\frac{1}{2}$	1 ,, 3'17	1 ,, 2'35	1 ,, 2'30	1 ,, 1'92	9 $8\frac{1}{4}$	29 0	46 $3\frac{3}{4}$	57 $4\frac{3}{4}$	91 0	184 8	1331 0
1 ,, $3\frac{3}{4}$	1 ,, 3'40	1 ,, 2'52	1 ,, 2'47	1 ,, 2'07	10 $4\frac{3}{4}$	31 1	49 8	61 8	95 3	193 1	1455 0
1 ,, 4	1 ,, 3'64	1 ,, 2'69	1 ,, 2'65	1 ,, 2'21	11 1	33 $1\frac{1}{2}$	53 $0\frac{3}{4}$	65 $11\frac{1}{2}$	99 5	201 6	1584 0
1 ,, $4\frac{1}{4}$	1 ,, 3'87	1 ,, 2'86	1 ,, 2'82	1 ,, 2'35	11 $9\frac{1}{2}$	35 $2\frac{1}{2}$	56 $5\frac{1}{2}$	70 $3\frac{1}{4}$	103 6	209 11	1719 0
1 ,, $4\frac{1}{2}$	1 ,, 4'11	1 ,, 3'03	1 ,, 3'00	1 ,, 2'49	12 $5\frac{1}{2}$	37 $3\frac{3}{4}$	59 10	74 $6\frac{1}{2}$	107 8	218 4	1859 0
1 ,, $4\frac{3}{4}$	1 ,, 4'34	1 ,, 3'21	1 ,, 3'17	1 ,, 2'64	13 2	39 $4\frac{1}{2}$	63 $2\frac{1}{2}$	78 $9\frac{1}{2}$	116 0	235 3	2156 0
1 ,, 5	1 ,, 4'58	1 ,, 3'38	1 ,, 3'34	1 ,, 2'78	13 $10\frac{1}{2}$	41 5	66 7	83 $0\frac{3}{4}$	124 3	253 1	2475 0
1 ,, $5\frac{1}{4}$	1 ,, 5'05	1 ,, 3'72	1 ,, 3'69	1 ,, 3'06	15 3	45 7	73 $4\frac{1}{2}$	91 7	132 6	268 11	2816 0
1 ,, 6	1 ,, 5'51	1 ,, 4'06	1 ,, 4'03	1 ,, 3'35	16 $7\frac{1}{2}$	49 $8\frac{1}{2}$	80 $1\frac{1}{4}$	100 1	140 10	227 11	3179 0
1 ,, $6\frac{1}{2}$	1 ,, 5'98	1 ,, 4'40	1 ,, 4'37	1 ,, 3'63	18 $0\frac{1}{2}$	53 10	86 10	108 $6\frac{1}{2}$	149 1	285 9	3564 0
1 ,, 7	1 ,, 6'44	1 ,, 4'74	1 ,, 4'72	1 ,, 3'91	19 5	57 $11\frac{1}{4}$	93 7	117 $0\frac{1}{2}$	241 4	302 8	
								539 0			

Angle of Crossing. a	Angle of Crossing. m	Angle of Crossing. n	Angle of Crossing. n_1	Angle of Crossing. p	Spring of Curve to Heel of Switches. d	Heel of Switches to Nose of Crossing. D	Heel of Switches to Knees of Crossing. E	Heel of Switches to Nose of Crossing. F	Heel of Switches to Knees of Crossing. M	Heel of Switches to Nose of Crossing. P	Radius of Curve. R
1 in $3\frac{1}{2}$	1 in 1'47	1 in 1'13	1 in 1'02	1 in 4'20	Ft. Ins. 20 $9\frac{1}{2}$	Ft. Ins. 62 2	Ft. Ins. 100 $3\frac{1}{2}$	Ft. Ins. 125 6	Ft. Ins. 619 0		
1 ,, 4	1 ,, 3'64	1 ,, 2'86	1 ,, 2'82	1 ,, 2'35	22 11	66 $3\frac{1}{2}$	107 $0\frac{3}{4}$	133 $1\frac{1}{2}$	704 0		
1 ,, $4\frac{1}{2}$	1 ,, 4'11	1 ,, 3'03	1 ,, 3'00	1 ,, 2'49	23 7	70 5	113 9	142 5	795 0		
1 ,, 5	1 ,, 4'58	1 ,, 3'38	1 ,, 3'34	1 ,, 2'78	24 11	74 7	120 6	150 10	891 0		
1 ,, $5\frac{1}{2}$	1 ,, 5'05	1 ,, 3'72	1 ,, 3'69	1 ,, 3'06	26 4	78 9	127 3	159 4	993 0		
1 ,, 6	1 ,, 5'51	1 ,, 4'06	1 ,, 4'03	1 ,, 3'35	27 9	82 10	133 11	167 9	1100 0		
1 ,, $6\frac{1}{2}$	1 ,, 5'98	1 ,, 4'40	1 ,, 4'37	1 ,, 3'63	29 1	87 0	140 8	176 3	1213 0		
1 ,, 7	1 ,, 6'44	1 ,, 4'74	1 ,, 4'72	1 ,, 3'91	30 6	91 0	147 4	184 8	1331 0		
					31 11	95 3	154 1	193 1	1455 0		
					33 3	99 5	160 9	201 6	1584 0		
					34 8	103 6	167 6	209 11	1719 0		
					36 1	107 8	174 2	218 4	1859 0		
					36 10	116 0	187 8	235 3	2156 0		
					38 10	124 3	201 1	253 1	2475 0		
					41 7	132 6	214 6	268 11	2816 0		
					42 11	140 10	227 11	285 9	3179 0		
					44 2	149 1	241 4	302 8	3564 0		
					45 5						


5 ft. 6 in. Gauge. Diagram No. 3.
Right and Left.
Right Hand.
Three-Throws, requiring one Set of Three-throw Switches and three Crossings.
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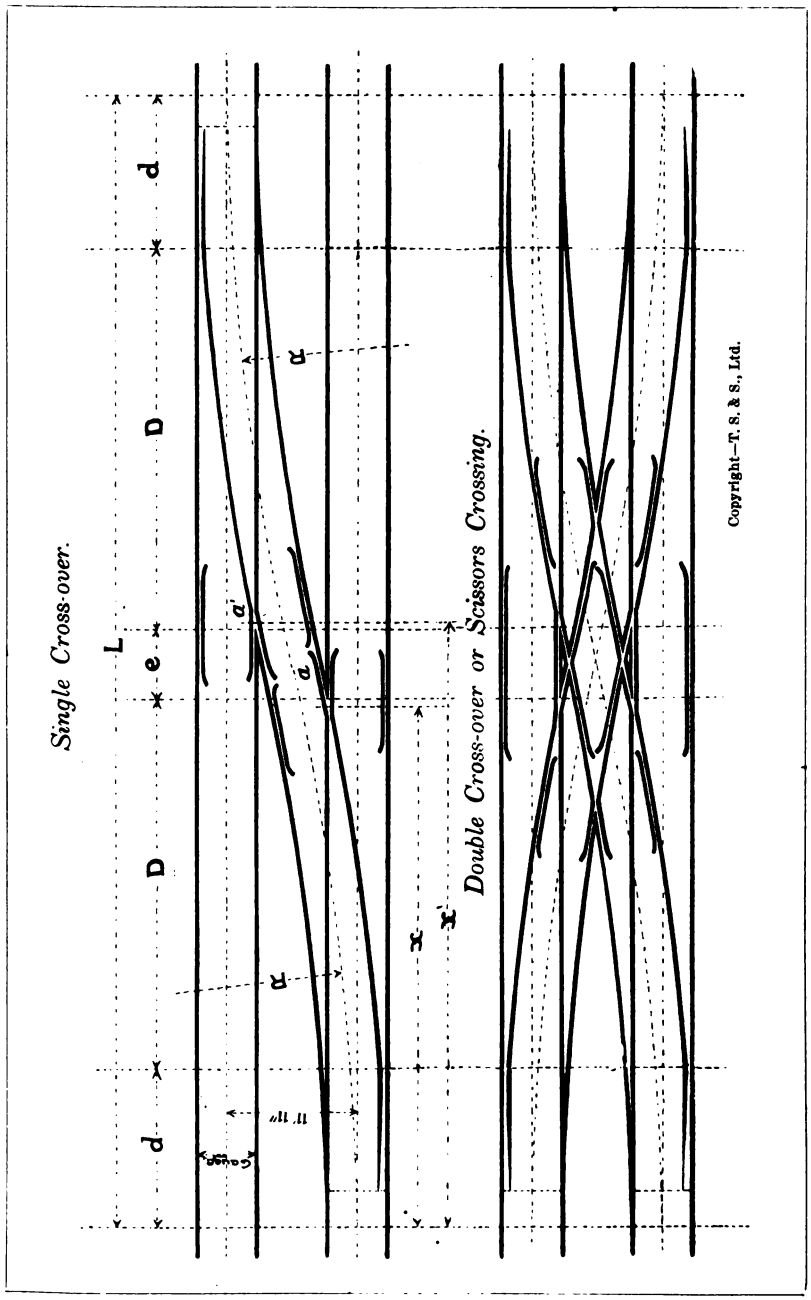
THREE THROWS.

5 ft. 6 in. Gauge. Table No. 3.

Angle of Crossings. a a¹	Angle of Crossing. b	Spring of Curve to Heel of Switches. d		Heel of Switches to Nose of Crossings. D		Heel of Switches to Nose of Crossing. K		Radius of Inside Curve. r		Radius of Curve. R	
		Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 1¾	1 in 1'21	4	10	14	6	9	1	17	0	34	0
1 ,, 2	1 ,, 1'39	5	6¼	16	7	10	4	22	0	44	0
1 ,, 2¼	1 ,, 1'57	6	2½	18	8	11	7	28	0	56	0
1 ,, 2½	1 ,, 1'75	6	11	20	8¾	12	9¾	34	6	69	0
1 ,, 2¾	1 ,, 1'93	7	7½	22	9½	14	0¾	42	6	84	6
1 ,, 3	1 ,, 2'10	8	3¾	24	10¼	15	3½	49	6	99	0
1 ,, 3¼	1 ,, 2'28	9	0	26	11	16	6¼	58	6	117	0
1 ,, 3½	1 ,, 2'46	9	8¼	29	0	17	9½	67	6	135	0
1 ,, 3¾	1 ,, 2'64	10	4½	31	1	19	0¼	77	6	155	0
1 ,, 4	1 ,, 2'82	11	1	33	1¾	20	3½	88	0	176	0
1 ,, 4¼	1 ,, 3'00	11	9½	35	2½	21	6½	99	6	199	0
1 ,, 4½	1 ,, 3'17	12	5½	37	3½	22	9½	112	0	223	0
1 ,, 4¾	1 ,, 3'34	13	2	39	4½	24	1	124	0	249	0
1 ,, 5	1 ,, 3'52	13	10½	41	5	25	4	138	0	275	0
1 ,, 5½	1 ,, 3'88	15	3	45	7	27	10	167	0	333	0
1 ,, 6	1 ,, 4'23	16	7½	49	8½	30	4	198	0	396	0
1 ,, 6½	1 ,, 4'58	18	0½	53	10	32	10	233	0	465	0
1 ,, 7	1 ,, 4'94	19	6	57	11½	35	4½	270	0	539	0

Angle of Crossings. a a¹	Angle of Crossing. b	Spring of Curve to Heel of Switches. d		Heel of Switches to Nose of Crossings. D		Heel of Switches to Nose of Crossing. K		Radius of Inside Curve. r		Radius of Curve. R	
		Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.
1 in 7½	1 in 5'29	20	9½	62	2	37	10½	310	0	619	0
1 ,, 8	1 ,, 5'65	22	2	66	3½	40	5	352	0	704	0
1 ,, 8½	1 ,, 6'00	23	7	70	5	42	11	398	0	795	0
1 ,, 9	1 ,, 6'36	24	11	74	7	45	6	446	0	891	0
1 ,, 9½	1 ,, 6'71	26	4	78	9	48	0	497	0	993	0
1 ,, 10	1 ,, 7'06	27	9	82	10	50	6	550	0	1100	0
1 ,, 10½	1 ,, 7'42	29	1	87	0	53	0	607	0	1213	0
1 ,, 11	1 ,, 7'77	30	6	91	0	55	6	666	0	1331	0
1 ,, 11½	1 ,, 8'12	31	11	95	3	58	0	728	0	1455	0
1 ,, 12	1 ,, 8'48	33	3	99	5	60	7	792	0	1584	0
1 ,, 12½	1 ,, 8'84	34	8	103	6	63	1	860	0	1719	0
1 ,, 13	1 ,, 9'19	36	1	107	8	65	7	930	0	1859	0
1 ,, 14	1 ,, 9'89	38	10	116	0	70	8	1078	0	2156	0
1 ,, 15	1 ,, 10'60	41	7	124	3	75	8	1238	0	2475	0
1 ,, 16	1 ,, 11'31	44	5	132	6	80	9	1408	0	2816	0
1 ,, 17	1 ,, 12'02	47	2	140	10	85	9	1590	0	3179	0
1 ,, 18	1 ,, 12'72	49	11	149	1	90	10	1782	0	3564	0



5 ft. 6 in. Gauge. Diagram No. 4.

SINGLE AND DOUBLE CROSS-OVERS.

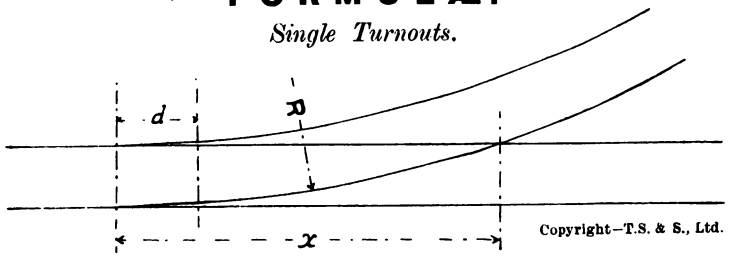
5 ft. 6 in. Gauge. Table No. 4.

Angle of Crossings, a a¹	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings, a a¹	e Nose to Nose of Crossings, a a¹	x Spring of Curve to intersection of Gauge Lines at Crossing a.	x¹ Spring of Curve to intersection of Gauge Lines at Crossing a¹	L Spring of Curve to Spring of Curve.	R Radius of Curve.
	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 11	4 10	14 6	—	19 3	19 0	38 3	34 0
1 ,, 12	5 6½	16 7	—	22 0	22 2½	44 2½	44 0
1 ,, 13	6 2½	18 8	0 4	24 9	25 4	50 1	56 0
1 ,, 14	6 11	20 8⅝	0 8	27 6	28 5½	55 11½	69 0
1 ,, 15	7 7½	22 9½	1 0½	30 3	31 7	61 10	84 6
1 ,, 16	8 3¾	24 10¾	1 3½	33 0	34 7½	67 7½	99 0
1 ,, 17	9 0	26 11	1 6⅝	35 9	37 8	73 5	117 0
1 ,, 18	9 8¼	29 0	1 9¾	38 6	40 8½	79 2½	135 0
1 ,, 19	10 4½	31 1	2 1	41 3	43 9	85 0	155 0
1 ,, 20	11 1	33 1⅛	2 4½	44 0	46 9½	90 10	176 0
1 ,, 21	11 9½	35 2⅛	2 7	46 9	49 10	96 7	199 0
1 ,, 22	12 5½	37 3⅛	2 10	49 6	52 10	102 4	223 0
1 ,, 23	13 2	39 4⅛	3 1	52 3	55 10	108 1	249 0
1 ,, 24	13 10½	41 5	3 3½	55 0	58 10½	113 10	275 0
1 ,, 25	15 3	45 7	3 8½	60 6	64 10½	125 4	333 0
1 ,, 26	16 7½	49 8½	4 2	66 0	70 10½	136 10	396 0
1 ,, 27	18 0½	53 10	4 7	71 6	76 10½	148 4	465 0
1 ,, 28	19 5	57 11½	5 0	77 0	82 10½	159 10	539 0

Angle of Crossings, a a¹	d Spring of Curve to Heel of Switches.	D Heel of Switches to Nose of Crossings, a a¹	e Nose to Nose of Crossings, a a¹	x Spring of Curve to intersection of Gauge Lines at Crossing a.	x¹ Spring of Curve to intersection of Gauge Lines at Crossing a¹	L Spring of Curve to Spring of Curve.	R Radius of Curve.
	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
1 in 7½	20 9½	62 2	5 5	82 6	88 10	171 4	619 0
1 ,, 8	22 2	66 3½	5 10½	88 0	94 10	182 10	704 0
1 ,, 8½	23 7	70 5	6 3	93 6	100 9	194 3	795 0
1 ,, 9	24 11	74 7	6 8	99 0	106 9	205 8	891 0
1 ,, 9½	26 4	78 9	7 1	104 6	112 8	217 2	993 0
1 ,, 10	27 9	82 10	7 6	110 0	118 8	228 8	1100 0
1 ,, 10½	29 1	87 0	7 11	115 6	124 8	240 2	1213 0
1 ,, 11	30 6	91 0	8 4	121 0	130 7	251 7	1331 0
1 ,, 11½	31 11	95 3	8 8	126 6	136 6	263 1	1455 0
1 ,, 12	33 3	99 5	9 1	132 0	142 6	274 6	1584 0
1 ,, 12½	34 8	103 6	9 6	137 6	148 5	285 11	1719 0
1 ,, 13	36 1	107 8	9 11	143 0	154 5	297 5	1859 0
1 ,, 14	38 10	116 0	10 9	154 0	166 4	320 4	2156 0
1 ,, 15	41 7	124 3	11 7	165 0	178 3	343 3	2475 0
1 ,, 16	44 5	132 6	12 4	176 0	190 2	366 2	2816 0
1 ,, 17	47 2	140 10	13 2	187 0	202 1	389 1	3179 0
1 ,, 18	49 11	149 1	13 11	198 0	214 0	412 0	3564 0

FORMULÆ.

Single Turnouts.

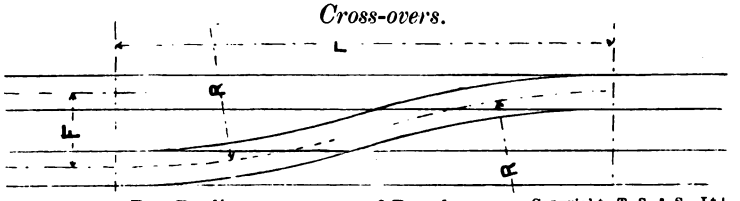


A = Angle of Crossing in units—*i.e.*, 6 for 1 in 6 crossing.
G = Gauge of Road.
R = Radius of Curve to Outside Rail.
x = Distance from spring of Curve to intersection of Gauge Lines.
d = Distance from spring of Curve to Heel of Switches,
All in feet.

$$A = \sqrt{\frac{R}{2G} - \frac{1}{4}} \qquad R = 2G\,(A^2 + \tfrac{1}{4}) \qquad x = 2\,AG. \quad x = \sqrt{2\,RG - G^2}$$

$$A = \frac{x}{2G} \qquad R = \frac{x^2}{2G} + \frac{G}{2} \qquad d = \frac{A + x}{4}$$

Cross-overs.

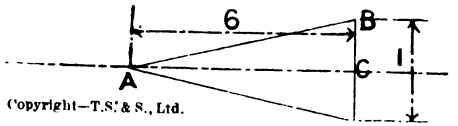
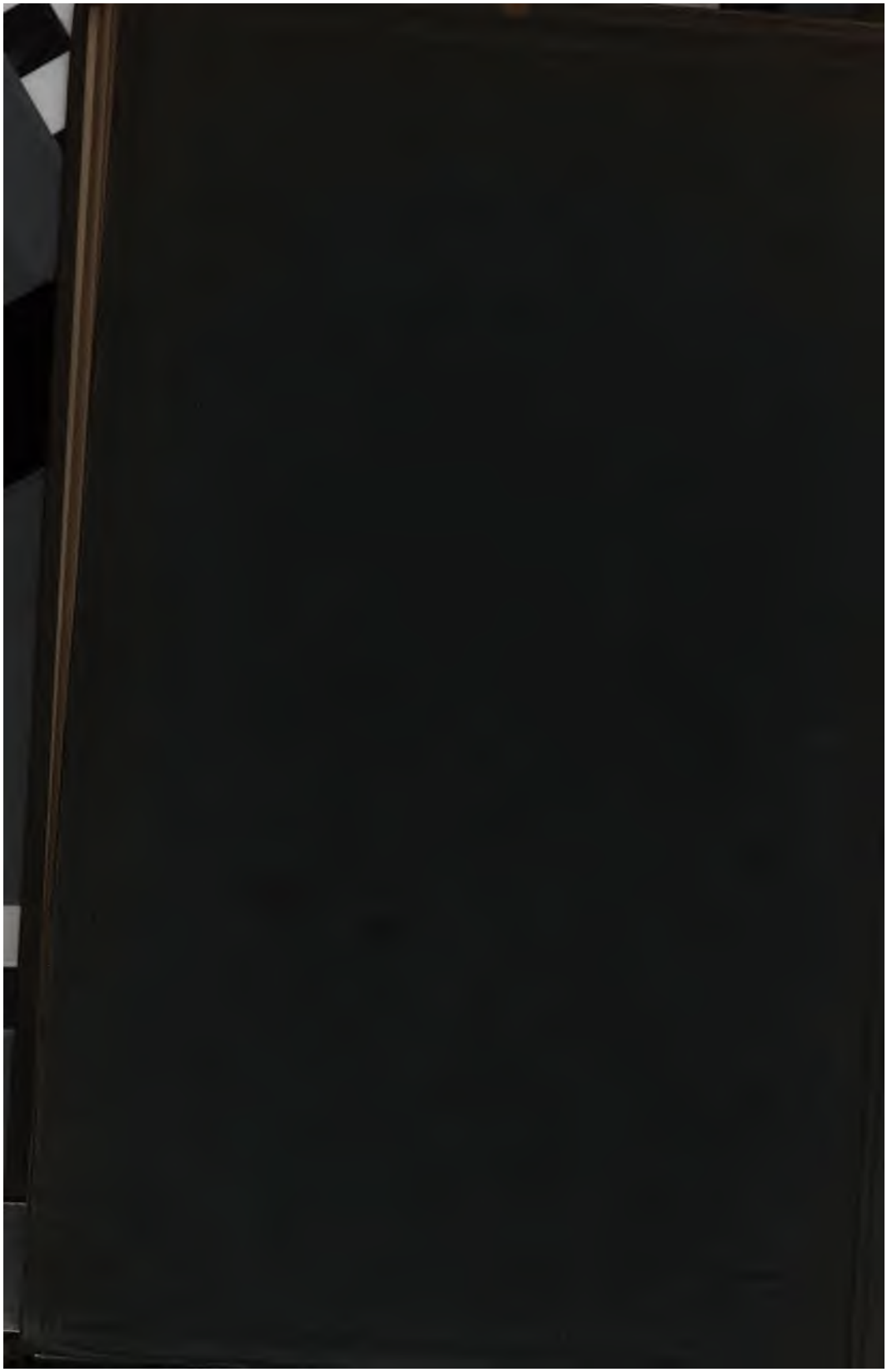


R = Radius to centre of Road.
F = Distance, centre to centre of Roads.
L = Distance between springing of Curves.

$$L = 2\sqrt{RF - \frac{F^2}{4}} \qquad R = \frac{L^2}{4F} + \frac{F}{4}$$

All in feet.

These formulæ apply to angles measured as shown in the following diagram, which represents a 1 in 6 crossing.



The difference between measuring along the side A B, and along the centre A C, except for very obtuse angles (1 in $2\frac{1}{2}$ and under), is of no practical importance.